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General Accounting Office

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COMPLETED

No Federal Programs Are Designed Primarily To Support Engineering Education, But Many Do

GAO describes Federal civilian agency support for engineering education in 1980. The support is placed in categories, current concerns about the supply of engineers and conditions of engineering schools are related to the support, and the changes made by the FY 1982 budget are identified.

GAO found that 38 programs in 11 Federal agencies provided more than $240 million for engineering education in 1980. About 79 percent of this was from the U.S. Department of Education's Student Financial Assistance program. None of the programs were primarily intended to support engineering education.

Most Federal funding was related to concerns about the supply of engineers. Comparatively little was related to how well the engineering schools are doing.

FY 1982 funding should not substantially change the general character of Federal support although funding levels for individual programs may be significantly altered.

GAO/PAD-82-20
MAY 14, 1982

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

PROGRAM ANALYSIS
DIVISION

B-205982

The Honorable Don Fuqua, Chairman
Committee on Science and Technology
House of Representatives

The Honorable Doug Walgren, Chairman
Subcommittee on Science, Research
and Technology
Committee on Science and Technology
House of Representatives

In response to your requests, we have prepared this report describing Federal support for engineering education. The report presents, in final form, the preliminary information which we provided to your staff and elaborates and substantiates our testimony before the full Committee.

As requested, one part of the report describes Federal assistance in areas of major current concern in engineering education. Also, as requested, we have provided an analysis of changes in Federal support which would result from adoption of the proposed fiscal year 1982 budget, and we are distributing the report very broadly across the Congress.

We are sending copies of this report to appropriate committees of both Houses, Representatives and Senators with particular interest, the Director of the Office of Management and Budget, the Director of the Office of Science and Technology Policy, and to the chief officials of the following agencies: the Departments of Agriculture, Commerce, Education, Energy, Health and Human Services, the Interior, and Transportation; the Environmental Protection Agency; the General Services Administration; the National Aeronautics and Space Administration; and the National Science Foundation. We will also make copies available to interested organizations and individuals, as appropriate, on request.

If we can be of further assistance to you, please do not hesitate to contact us.

Morton A. Myers
Morton A. Myers
Director

REPORT BY THE U.S.
GENERAL ACCOUNTING OFFICE

NO FEDERAL PROGRAMS ARE DESIGNED PRIMARILY TO SUPPORT ENGINEERING EDUCATION, BUT MANY DO

DIGEST

The Chairmen of the House Committee on Science and Technology and the House Subcommittee on Science, Research and Technology expressed concern about possible shortages of engineers and problems in the engineering schools. They asked GAO to identify and describe Federal programs that support engineering education and show how this support may change between fiscal years 1980 and 1982. They also asked GAO to relate Federal support to current concerns about engineering education.

THIRTY-EIGHT FEDERAL PROGRAMS PROVIDE SOME SUPPORT

Sources. GAO found that 38 programs in 11 civilian agencies provided some support for engineering education in 1980. (Department of Defense and Veterans' Administration programs were not surveyed). Thirty-five of these programs were run by single Federal agencies; three had several agencies participating. None of these programs were primarily intended to support engineering education.

Our analysis of funding levels includes only the 35 single-agency programs because budget data were not available in sufficient detail for the multi-agency programs. Assistance to engineering education in 1980 from the 35 programs was approximately $240 million. Department of Education Student Financial Assistance made up about 79 percent of this total. Another 10 percent went to federally subsidized academies (e.g., Merchant Marine and Coast Guard). (See appendix I for a detailed description of each program.)

The three multi-agency programs were research and development grants (supporting 6,901 engineering graduate students in 1980), Cooperative Education Employment in Federal agencies (employing an estimated 1,572 engineering students in 1980), and used Federal property donated to many schools. (See pp. 11 to 14 and appendix III.)

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MAY 14, 1982

Objectives. GAO found that none of these 38 programs were primarily intended to support engineering education. However, they did provide support while pursuing other objectives:

- --support for education in general or science education in particular, and
- --advancement of agency scientific and technical missions.

GAO found that the 12 programs with the first objective provided the majority of assistance to engineering education. Twenty-five programs had the second objective, and one program had elements of both.

Targets. GAO found six parts of the engineering education system that received Federal support in 1980. Following are the portions provided through single-agency programs (in millions of dollars):

	Federal Support FY80	Federal Support FY82
Student Support------------	$203.0	$243.5
Instructional Equipment----	6.9	4.4
Institutional Operation----	28.0	24.9
Educational Capability Improvement----------------	3.9	2.3
Curriculum Development-----	2.8	0.1
Faculty Development--------	1.3	0.9

Among multi-agency programs, research and development grants supported about 4 percent of all engineering students who received some Federal assistance in 1980. Used Federal property programs provided significant amounts of research equipment to U.S. universities, but precise data on its use for instructional purposes were not available.

Concerns. GAO identified two major areas of concern about engineering education: possible shortages of engineers and condition of engineering schools. Federal support for students relates to the first area of concern. Federal funds helped support approximately 157,000 engineering students in 1980--about one-third of all engineering students. Concerns about condition of the engineering schools focus on the supply of faculty, the adequacy of instructional equipment, and the development of curricula. Federal funding related to these concerns appeared to be much lower than funding related to the supply of engineers.

THE OVERALL CHARACTER OF FEDERAL ASSISTANCE IS UNLIKELY TO CHANGE IN FISCAL YEAR 1982

In fiscal year 1982, it is unlikely that the general character of Federal support for engineering education will change significantly. However, the funding levels of individual programs may be substantially altered.

Support for engineering education through single-agency programs may increase to nearly $268 million in fiscal year 1982, about 12 percent above the fiscal year 1980 level. However, most of the increase reflects a possible 23-percent rise in the Department of Education's Student Financial Assistance program. Support for the three federally subsidized academies may also increase (to $24.9 million). Thirteen programs could be terminated. Funding for the remaining 21 programs could drop by 58 percent to less than $12 million.

As shown in the chart, funding for student support should continue to account for the majority of Federal funds expended for engineering education in fiscal year 1982. Therefore, concern about the supply of engineers should continue to receive much more funding than the concern about the engineering schools.

The fiscal year 1982 funding data in our analysis reflects the budget proposals as of September 15, 1981. Changes that have occurred since that date are not reflected. However, GAO has found no indications that the basic pattern of Federal support will change substantially from what is described here.

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ABBREVIATIONS

DOC	Department of Commerce
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation
ED	Department of Education
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
GSA	General Services Administration
GSL	Guaranteed Student Loan Program
HHS	Department of Health and Human Services
NASA	National Aeronautics and Space Administration
n.d.	no data
NSF	National Science Foundation
OPM	Office of Personnel Management
R&D	Research and Development
USDA	Department of Agriculture

CHAPTER 1

INTRODUCTION

The Chairman of the House Committee on Science and Technology, and the Chairman of the House Subcommittee on Science, Research, and Technology wrote the General Accounting Office to express concern about conditions of American engineering schools and possible shortages of engineers. Their concerns stem from the implications that problems in these areas have for the Nation's economic recovery. They requested a study be done on engineering education programs within the Federal Government, the size and scope of such activities, how these activities relate to the current issues and concerns about engineering education, and how funding levels will change from FY 1980 to FY 1982. These questions supplied the framework for our research.

OBJECTIVES, SCOPE, AND METHODOLOGY

In response to these requests, we developed this overview of 1980 Federal support for engineering education for the Congress to use in its authorization and oversight functions. Though it is generally known that many Federal agencies may in some way affect engineering education, such an overview did not previously exist.

The Federal effort is described as it existed in 1980 since this was the most recent year for which complete program and budget information were available. Programs that stopped operating before 1980 or started in 1981 were not included.

We split the overview into three parts. First, we identified and described all Federal programs that supported engineering education. (chapter 2) To effectively describe these programs, we answered three questions: How was support distributed among agencies? What broad objectives were being addressed and how were resources distributed among them? What parts of the engineering education system were supported and how were resources distributed among the parts? Second, we identified areas of concern about engineering education by examining the literature and conducting interviews and determined assistance levels in each area. (chapter 3) Third, we determined how Federal support changes from FY 1980 to FY 1982. (chapter 4)

Limitations

In our review, we neither examined program operations nor attempted to evaluate their effects or effectiveness.

Our scope was limited to programs that addressed undergraduate and graduate engineering. We did not include continuing education programs, programs to train technicians, or programs or components of programs that focused on postdoctoral support. Programs whose primary purpose was to promote improved access to science and engineering careers for women and minorities were not included because their focus was on equity, and they only incidentally addressed engineering education. International exchange programs also were not included in our scope. We did not include Department of Defense or Veterans Administration programs in our scope because of time and resource limitations.

Because we focused on support for educational activities, we did not gather detailed information on most agency research programs. Exceptions were made when university research was sponsored primarily to advance the education of participating students. Since many of these programs were designed to further both education and research, it was often difficult to distinguish the primary objective.

Identifying and describing programs

To identify programs that provided support for engineering education, we reviewed available source documents, such as the Budget Appendix, agency budget justifications, and the Catalog of Federal Domestic Assistance. We interviewed agency officials and examined agency documents to ensure that we had included all relevant Federal efforts.

After identifying these programs, we completed data collection by examining legislation and regulations and interviewing program officials. These operations allowed us to determine how Federal support was distributed across program objectives and across the parts of the engineering education system that were being supported.

For all programs, we attempted to determine both total funding and the percentage expended for engineering education. In many cases, program officials were able to provide precise percentages. In other cases, such preciseness was unattainable, so officials provided estimates. Unless otherwise stated, funding information is expressed in terms of budget authority, because when we conducted this study this was the most readily available financial measure that provided the necessary level of detail. Also, the years cited are fiscal years unless otherwise indicated.

Sources of support

We classified the programs that provided support for engineering education into two categories--agency-specific and cross-agency. Agency-specific programs are unique to a single agency. The following agencies operated such programs and are included in our overview: the Departments of Agriculture, Commerce, Education, Energy, Health and Human Services, the Interior, and Transportation; the Environmental Protection Agency; the National Aeronautics and Space Administration; and the National Science Foundation.

On the other hand, cross-agency programs are operated across many agencies. The available data on these activities were not complete or precise enough to be combined with agency-specific program information to present overall totals. Funding figures cited in the report, therefore, generally reflect only agency-specific programs.

Appendix I presents detailed information on 34 agency-specific programs. Appendix II presents detailed information on the 35th agency-specific program--the U.S. Department of Education's Student Financial Assistance Program. This program was sufficiently different from other agency-specific programs to warrant a separate discussion. Appendix III presents detailed information on cross-agency activities. All of this information has been verified by appropriate agency officials.

Objectives of support

We also classified Federal support for engineering education by the primary objectives of programs providing funding. The objective of one group of programs was to support education across all fields or, in some cases, across all scientific fields. Because of this broad objective, engineering was also supported. The objective of the remaining programs was to advance agency scientific and technical missions. While addressing this objective, Federal activities supported engineering education only as it contributed to these ends. Each objective was addressed by both agency-specific and cross-agency programs.

Targets of support

We divided the engineering education system into six parts that were the targets of Federal support: student support, instructional equipment, institutional operation, institutional development (educational capability improvement), curriculum development and dissemination, and faculty development.

Identifying current concerns

In order to identify major current concerns about engineering education, we reviewed relevant analyses, articles, and statements, including

--congressional testimony by government, industry, and university representatives;

--a report, *Science and Engineering Education for the 1980s and Beyond*, prepared by the National Science Foundation and the U.S. Department of Education 1/ along with the various papers that were prepared by Government officials, professional associations, and others as input to the report; and

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1/National Science Foundation and U.S. Department of Education, *Science and Engineering Education for the 1980s and Beyond* (Washington, D.C., 1980).

--a report, Issues in Engineering Education, prepared by the National Academy of Engineering. 1/

We also interviewed Government officials, engineering deans, engineering professional society representatives, and labor supply experts.

We analyzed program and funding information to determine how Federal involvement responded to major concerns. We did not evaluate these concerns or determine whether or not problems in fact existed. We also did not attempt to evaluate the adequacy of the Federal activities in addressing current concerns.

Examining the changes made by the FY 1982 budget

Finally, we determined how engineering education support changes from fiscal year 1980 to fiscal year 1982. We obtained initial information about budget requests for 1982 from agency budget submissions and then updated and confirmed this information with agency officials and with GAO's Legislative Authorization, Program and Budget Information System data base. Our funding information is complete as of September 15, 1981. Changes that have occurred since that date are not reflected in the conclusions presented here.

In a few instances, officials could not provide complete information on their program's funding for engineering education overall or for one or more particular targets or areas of concern. A few could not supply a 1982 funding figure. Throughout the report we provide funding information that is as complete as possible. The detailed tables in appendix IV indicate where data were not available.

2/National Academy of Engineering, Issues in Engineering Education (Washington, D.C., 1981).

CHAPTER 2

FEDERAL SUPPORT FOR ENGINEERING EDUCATION

In developing our overview of Federal support of engineering education, we found that Federal assistance could be characterized by its source, objective, and target.

SOURCES OF FEDERAL SUPPORT

We identified 38 different Federal programs that provided support for engineering education in 1980. These programs and their funding levels are listed in table 1. Thirty-five are agency-specific and provided approximately $240 million for engineering education. (For detailed information on these programs, see appendix I.) The remaining three are cross-agency activities. Detailed funding information could not be provided for cross-agency activities because the available data were insufficient.

Agency-specific programs

Department of Agriculture

The Department of Agriculture (USDA) had one program of Aid to Land-Grant Colleges that provided some support for engineering education. Commonly known as the "Bankhead-Jones" program, its purpose was to help support instruction in a range of subjects at land-grant institutions, with an emphasis in agriculture and science. Approximately 80 percent of this program's engineering education funds was expended on faculty salaries.

Department of Commerce

The Department of Commerce (DOC) had a single program that addressed engineering education. The National Sea Grant program was established to support education relating to marine resources in many disciplines, including engineering. Among the various activities sponsored in 1980 by Sea Grant Marine Education were curriculum development projects and student support in the form of research assistantships, internships, and Sea Grant Fellowships. Commerce could not provide data that would allow the portion of funds devoted to engineering education to be determined.

Department of Education

The Department of Education (ED) administered five programs that provided support for engineering education. Three supported education across many fields, including engineering--the Morrill-Nelson, Cooperative Education, and Student Financial Assistance programs. Two supported engineering education as it advanced scientific or technical missions--the Domestic Mining and Mineral and Mineral Fuel Conservation Fellowship Program and the Rehabilitation Engineering Traineeship Program.

Table 1

1980 Sources of Federal Support for Engineering Education (Budget Authority in Thousands)

Agency/Program	Total Funding	Percent for Engineering Education	Engineering Education Portion
Agency-Specific Programs			
Dept. of Agriculture			
Aid to Land-Grant Colleges (Bankhead-Jones)	$ 11,500	20.0%	$ 2,300
Dept. of Commerce			
Sea Grant Marine Education a/	1,563	n.d.	n.d.
Dept. of Education			
Aid to Land-Grant Colleges b/ (Morrill-Nelson)	2,700	22.0	594
Cooperative Education Program	15,000	11.5	1,725
Domestic Mining and Mineral and Mineral Fuel Conservation Fellowship Program	4,500	66.1	2,975
Rehabilitation Engineering Traineeship Program	104	100.0	104
Student Financial Assistance Program	5,238,094	3.6	188,571
Dept. of Energy			
University/Laboratory Cooperative Program	3,200	20.0	640
University Reactor Fuel Assistance Program	1,700	50.0	850
Magnetic Fusion Energy Technology Fellowship Program c/	20	100.0	20

a/Total includes only the portions of Marine Education that are devoted to course development, research assistantships, internships, and Sea Grant Fellowships.

b/Percentage based on 1979 data.

c/Budget figure represents start-up costs only in 1980.

Agency/Program	Total Funding	Percent for Engineering Education	Engineering Education Portion
Dept. of Energy (Cont'd)			
Solar Energy Meteorological Research and Training Site Program	$ 1,000	20.0%	$ 200
DOE-ASEE Summer Faculty Program in Solar Thermal R&D	168	52.2	88
Dept. of Health & Human Services			
National Research Service Awards a/ (Predoctoral Institutional Training Grants)	53,737	2.5	1,343
Dept. of the Interior			
State Mining and Mineral Resources and Research Institutes Program	10,000	72.0	7,200
Dept. of Transportation			
U.S. Coast Guard Academy	28,600	30.6	8,752
Aid to State Maritime Academies	11,459	50.0	5,730
U.S. Merchant Marine Academy	17,431	50.0	8,716
FHWA Fellowship and Scholarship Program	459	52.6	241
University-FHWA College Curriculum Program	29	70.0	20
Center of Excellence in Motor Vehicle Safety Research	312	95.0	296
Environmental Protection Agency			
Air Pollution Traineeship Program	380	50.0	190
Academic Grants in Solid Waste Technology	120	50.0	60

a/Percentage based on 1979 data.

Table 1 (cont'd)

Agency/Program	Total Funding	Percent for Engineering Education	Engineering Education Portion
Academic Training Program in Water Pollution Control	$ 438	75.0%	$ 329
National Aeronautics & Space Administration			
Computational Fluid Dynamics Training Program	375	72.0	270
Graduate Research Program in Aeronautics	800	100.0	800
Post-Baccalaureate Program in Aeronautics	500	100.0	500
Graduate Student Researchers Program	385	39.5	152
Summer Faculty Fellowship Program	1,580	41.2	651
National Science Foundation			
Development in Science Education	8,105	13.6	1,102
Comprehensive Assistance to Undergraduate Science Education	13,291	16.1	2,140
Instructional Scientific Equipment Program	2,771	19.6	543
Local Course Improvement	2,908	18.9	550
Graduate Fellowship Program	10,905	14.3	1,559
Science Faculty Programs	3,212	6.7	215
Undergraduate Research Participation	2,832	9.5	269
Cross-Agency Activities			
All Agencies			
R&D Grant Funding a/	3,733,000	n.d.	n.d.

a/Figure indicates R&D grant funding to colleges and universities.

Agency/Program	Total Funding	Percent for Engineering Education	Engineering Education Portion
All Except NSF & ED			
Federal Cooperative Education Employment Program (coordinated by OPM) a/	n.d.	20.8%	n.d.
GSA, NSF, DOE			
Used Federal Property Disposal b/			
Surplus Federal Property Donation (GSA) c/	118,707	n.d.	n.d.
Transfer of Excess Scientific Equipment (NSF) d/	24,317	n.d.	n.d.
Used Energy-Related Laboratory Equipment Grants Program (DOE) d/	378	n.d.	n.d.

a/Salaries are paid by each participating agency; cumulative totals are not available. Percent indicates portion of participating students in engineering fields.

b/Figures for used property indicate original acquisition value of distributed items.

c/Figure indicates portion of property donated for educational purposes.

d/Equipment distributed through these programs is intended for research purposes. An unknown portion is used for instruction.

The Morrill-Nelson program of assistance to land-grant colleges is similar in objectives and scope to the Bankhead-Jones program. About 90 percent of this program's funds for engineering education went toward faculty salaries. The Cooperative Education Program funded the administration of programs to provide combined study and subject-related work for students in many fields.

In 1980, the Government provided about $5.2 billion to assist post-secondary students in financing their education through the six programs that are included under the Student Financial Assistance Program. 1/ The objective of this assistance was to promote equity by helping to lower the financial barriers that might have otherwise prevented some individuals from obtaining post-secondary education. We estimated that nearly four times as much Federal funding was provided to engineering education through this effort as through all of the other 34 agency-specific programs combined. This comparison of budget authority underrepresents considerably the actual amount of assistance received by engineering students from these programs. The addition of matching funds in several programs and the indirect relationship between costs and loan volume in the loan programs prevented budget authority from accurately reflecting the volume of assistance received by students in all fields, which was about $9.1 billion in 1980.

Two ED programs were designed to support graduate study in academic disciplines related to specific scientific or technical missions. The Domestic Mining and Mineral and Mineral Fuel Conservation Fellowships Program provided about two-thirds of its 1980 support to students in appropriate subfields of engineering, such as metallurgical, mineral, geological, and mining. The Rehabilitation Engineering Traineeship Program supported study in rehabilitation engineering. These two programs combined expended nearly all their funds in the form of student support.

1/Pell Grants (formerly Basic Educational Opportunity Grants), Supplementary Educational Opportunity Grants (SEOG), and State Student Incentive Grants (SSIG) provided outright grants to needy students, with the latter program requiring 1-1 State matching funds. The College Work/Study Program provided 80 percent funding for student salaries to promote their part-time employment (the remainder was paid by the employer). The last two programs--National Direct Student Loans (NDSL) and Guaranteed Student Loans (GSL)--subsidized low-interest loans for college students. Annual NDSL appropriations are used to establish and maintain revolving loan funds at institutions of higher education, with an institutional capital contribution of one-ninth of the Federal contribution added to the Federal monies. GSL funds are not distributed directly to students. These monies, rather, are used to subsidize low-interest loans by private lending institutions.

Department of Energy

Five programs administered by the Department of Energy (DOE) provided support for engineering education. They were all designed to enhance research and training opportunities for students or faculty in DOE's mission area. In 1980, nearly all of the amount spent on engineering went for instructional equipment, student support, and faculty development.

Department of Health and Human Services

The Department of Health and Human Services (HHS) operated the National Research Service Awards program to support students in the National Institutes of Health's mission area--biomedical and behavioral science. In 1980, one subelement of this program, Predoctoral Institutional Training Grants, funded study in biomedical engineering by 139 graduate students at a cost of about $1,343,000. This was equivalent to 2.5 percent of this subelement, or less than 0.1 percent of the total program.

Department of the Interior

The Department of the Interior (DOI) administered one program that provided support for engineering education. The State Mining and Mineral Resources and Research Institutes Program was designed to enhance training opportunities in areas that are related to Interior's mission in mining and minerals policies and programs. A majority of the funds that went to engineering education were devoted to student support, institutional operation, and instructional equipment.

The Department of Transportation

The Department of Transportation (DOT) provided funding for engineering education through programs that subsidized study in two mission-related areas. The first of these areas is maritime transportation and safety. To this end, it gave full support for the U.S. Merchant Marine and Coast Guard academies and partial support for the State Maritime academies. The two U.S. academies were almost completely subsidized, while the State academies received partial student support and operational assistance payments and were provided with schoolships. [1] Approximately 50 percent of the graduates of the maritime academies studied marine engineering, while about 30 percent of the Coast Guard graduates were engineering majors.

DOT also supported education in the area of highway safety and technology. Together, the Federal Highway Administration (FHWA) Fellowship and Scholarship Program and the Center of Excellence in

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[1] Schoolships are merchant vessels that are used for instructional purposes.

Motor Vehicle Safety Research program used about three-fourths of their 1980 engineering education funding for student support. The University-FHWA College Curriculum Program expended funds to provide academic institutions with state-of-the-art highway technology training and educational materials.

Environmental Protection Agency

The Environmental Protection Agency (EPA) operated three programs that supported education in mission-related fields. Two of these efforts, Air Pollution Traineeships and the Academic Training Program in Water Pollution Control, provided support for students in appropriate fields. The Academic Grants in Solid Waste Technology program and a small portion of the water pollution program funded curriculum development in specified fields.

National Aeronautics and Space Administration

The National Aeronautics and Space Administration (NASA) had five programs that provided support for engineering education. Four of these assisted students in areas related to NASA's mission. Two areas singled out for special attention were computational fluid dynamics and aeronautical engineering. The fifth program, Summer Faculty Fellowships, provided funds for faculty development in engineering and other mission-related fields.

National Science Foundation

The National Science Foundation's (NSF) Science and Engineering Education Directorate operated many programs that were directed at upgrading different components of science education across all fields. Seven of these programs provided support for engineering education.

Two of these, the Graduate Fellowship and Undergraduate Research Participation programs, provided support for engineering students in 1980. The Instructional Scientific Equipment Program (ISEP) provided funds for engineering instructional equipment. The Science Faculty Programs expended funds for engineering faculty development. Three other programs supported development of an institution's educational capability or improvement of curricula in engineering.

Cross-agency activities

In the course of identifying programs that supported engineering education, we found three activities that were common to more than one agency. These were research and development (R&D) grant funding, the Federal Cooperative Education Employment Program, and the Government's mechanisms for disposing of used Federal property. Appendix III provides detailed descriptions of these activities.

Research and development grant funding

In 1980, Federal civilian agencies granted colleges and universities about $3.7 billion in research and development funds for study in areas related to agency missions. 1/ About 7.5 percent of these funds was directed to engineering 2/ and provided educational assistance in two ways--support for students and funds for new instructional equipment.

Individual agencies could not provide information concerning the numbers of students supported by their R&D funding. NSF does gather such information, but it is not broken down by agency. Their survey showed that 6,901 engineering graduate students were supported by research assistantships funded from Federal civilian sources in 1980. 3/ About 300 of these students were supported by agency-specific programs that used research funding as a vehicle to provide support for students in particular fields. The remaining 6,600 students were supported by other R&D grants, particularly in the areas of mechanical, electrical, chemical, and civil engineering. No information was available on undergraduate support.

Federal grants provided a considerable amount of R&D equipment to institutions of higher education. Because of the close link between research and training, particularly at the graduate level, this equipment is often used for instructional purposes. According to an NSF survey, about 14 percent of the total amount provided, or $21,440,000, was spent for engineering equipment. 4/

Federal Cooperative Education Employment Program

In 1980, many Federal agencies, with the exceptions of NSF and ED, participated in the Federal Cooperative Education Employment Program, which is coordinated by the Office of Personnel Management (OPM). The program serves a dual purpose as both a recruitment vehicle for Federal agencies and an educationally related work experience for the participating students. The program provides

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1/Willis Shapley, et al., Research and Development: AAAS Report VI, New Directions for R&D: Federal Budget--FY 1982 (American Association for the Advancement of Science, Washington, D.C.), p. 25.

2/National Science Foundation, Federal Support to Universities, Colleges, and Selected Nonprofit Institutions, FY 1980 (in press), Detailed Statistical Tables, Tables B-2 and B-20.

3/National Science Foundation, Academic Science: Graduate Enrollment and Support, Fall 1980, NSF 81-330, Detailed Statistical Tables, Table IV-A-2, p. 165.

4/National Science Foundation, Academic Science 1972-81: R&D Funds, Scientists and Engineers, Graduate Enrollment and Support, NSF 82-300 (in press), Detailed Statistical Tables, Table B-41.

temporary employment in many academic disciplines. In 1980, an estimated 1,572 engineering students were employed in the agencies within our scope; 99 percent of them were undergraduates.

Disposal of used Federal property

The Government annually disposes of used Federal personal property [1] that has a total original acquisition cost in the billions of dollars. Some of this property is donated to universities and colleges, with engineering and many other disciplines benefiting. Prime responsiblity for this activity lies with the General Services Administration (GSA), and with two other agencies--NSF and DOE.

In 1980, the GSA coordinated a comprehensive system for the transfer or disposal of excess and surplus Federal property. [2] One significant aspect of this operation was the setting aside of surplus personal property for donation through State agencies. "Educational purposes" were explicitly delineated as one use for this property. No breakdown as to the field or level of education was available. NSF coordinated a program that transmitted excess scientific equipment from Federal agencies to its research grantees. The Department of Energy distributed its own excess laboratory equipment for energy-related research at universities but could not estimate what portion went for engineering.

OBJECTIVES OF FEDERAL SUPPORT

In our review of Federal activities, we found no programs that were primarily intended to support engineering education. We found, rather, that programs directed at two other broad objectives provided such support indirectly. One group of programs was directed at education across all fields or, in some cases, across all scientific fields, with engineering one of many subject areas receiving support. Another group was designed to advance agency scientific and technical missions and supported engineering education only as it contributed to this goal. Both agency-specific and cross-agency programs were included in each group.

Programs that addressed educational objectives

Most programs in this category provided assistance across a great many subject fields but some were more narrowly focused. The Federal programs that supported engineering education while

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1/Personal property is property of any kind, except real property, records, and certain naval vessels.

2/Excess property is property determined to be unneeded by the Federal agency having possesion of it; however, it may be needed by one or more Federal agencies. Surplus property is property determined to be unneeded by the entire Federal Government.

addressing broader educational objectives are listed in table 2. A detailed breakdown by individual program is available in appendix IV.

Table 2

1980 Funding from Programs with Educational Objectives
(Budget Authority in Thousands)

Program	Total Funding	Percent for Engineering Education	Engineering Education Portion
Science and Engineering Education Programs (NSF)	$ 44,024	14.5%	$ 6,378
Aid to Instruction at Land-Grant Colleges (USDA, ED)	14,200	20.4	2,894
Cooperative Education (ED)	15,000	11.5	1,725
Student Financial Assistance (ED)	5,238,094	3.6	188,571
Federal Cooperative Education Employment Program (Coordinated by OPM) a/	n.d.	20.8	n.d.
Surplus Federal Property Donation (GSA) b/	118,707	n.d.	n.d.

a/Salaries are paid by each participating agency; cumulative totals are not available. Percent indicates portion of participating students in engineering fields.

b/Figures for used property indicate original aquisition value of distributed items. This figure indicates portion of property donated for educational purposes.

The most strictly focused contributors were the seven NSF programs, as they were designed to support education across science and engineering fields only. Land-grant college aid represented the middle of the support spectrum, as it was loosely restricted to "agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural and economic science . . . ." It devoted 20.4 percent of its funds to engineering in 1980.

The remaining four programs were the least restricted as they provided assistance across a great range of subjects. Program officials were able to indicate the percentage of funding devoted to engineering education for three of these, and they ranged from a high of 20.8 percent in the Federal Cooperative Education Employment Program to a low of 3.6 percent in the Student Financial Assistance Program.

Programs that addressed agency scientific and technical missions

Eight Federal agency scientific and technical mission responsibilities were advanced through agency-specific programs that devoted at least some percentage of their funding to engineering education. The percentage varied from 2.7 to 70.2. These mission areas, along with the total and engineering funding amounts, are listed in table 3. Detailed information on the funding in each area by program is available in appendix IV.

About 58 percent of funding for engineering education provided by programs with scientific and technical missions was support for undergraduate education in marine and ocean engineering and several other disciplines at the Federal and State Maritime academies and at the Coast Guard Academy. DOT provided this support. The Departments of the Interior and Education had programs in disciplines related to mining and minerals, such as mining, metallurgical, and petroleum engineering, and were the next largest contributors. Third was NASA's five programs that supported education in aeronautical engineering and computational fluid dynamics. Programs in the next two mission areas provided about equal support to engineering education. DOE operated five programs that assisted education in energy-related fields, including nuclear and solar engineering. HHS' National Research Service Awards and ED's Rehabilitation Engineering Traineeships supported students in subfields of biomedical engineering. Programs in EPA and DOT contributed nearly equal amounts and are the last programs for which funding information in this category was available. EPA's three programs supported education in environmental engineering and related specialties. DOT's three highway transportation and safety programs assisted education in appropriate subspecialties, mainly mechanical and electrical engineering. The Department of Commerce's Sea Grant program supported instruction in fields related to marine resources, such as ocean engineering. The amount of funding is unknown.

Table 3

1980 Funding from Programs with Scientific and Technical Mission-Related Objectives (Budget Authority in Thousands)

Mission Area	Total Funding	Percent for Engineering Education	Engineering Education Portion
Maritime Transportation and Safety (DOT)	$ 57,490	40.4%	$23,198
Mining and Minerals (ED, DOI)	14,500	70.2	10,175
Aeronautics/Space (NASA)	3,640	65.2	2,373
Energy (DOE)	6,088	29.5	1,798
Biomedical and Behavioral Science (HHS, ED)	53,841	2.7	1,447
Highway Technology and Safety (DOT)	800	69.6	557
Environmental Protection (EPA)	938	61.7	579
Marine Resources (DOC)	1,563	n.d.	n.d.
Research and Development Grant Funding (all agencies) a/	3,733,000	n.d.	n.d.
Used Federal Property Disposal (NSF, DOE) b/	24,695	n.d.	n.d.

a/Figure indicates research and development grant funding to colleges and universities.

b/Figures for used property indicate original acquisition value of distributed items. Equipment distributed through these programs is intended for research purposes. An unknown portion is used for instruction.

Two cross-agency programs--research and development grants and the disposal of used equipment--also helped agencies advance their assigned missions. As we have previously noted, R&D monies supported 6,600 graduate engineering students in 1980 and also provided a significant amount of instructional equipment. The used equipment donation programs at NSF and DOE advanced research in areas related to the goals of those agencies.

TARGETS OF FEDERAL SUPPORT

In our review of Federal efforts that helped support engineering education, we identified six parts of the educational system that were the targets of Federal support. These are listed in table 4, along with funding for each part received from agency-specific programs, Detailed tables, listing individual programs, are available in appendix IV.

Table 4

1980 Funding for Engineering Education: a/
Targets of Support
(Budget Authority in Thousands)

Target	Funding
Student Support	$203,010
Instructional Equipment	6,867
Institutional Operation	28,181
Institutional Development	3,865
Curriculum Development and Dissemination	2,777
Faculty Development	1,263

a/This table does not include support provided by cross-agency programs. Such support is, however, discussed in the text where appropriate.

Student support

The largest portion of Federal assistance went to engineering students through five major mechanisms. They are illustrated in table 5.

We estimated that the total number of engineering students who received at least partial assistance from all Federal sources combined in 1980 was approximately 157,000. Approximately 93 percent of these were recipients of the Department of Education's student financial assistance. R&D grant funding supported an additional 4 percent. Programs to train students in agency mission-related fields supported about 2 percent. The remaining 1 percent was mainly accounted for by Federal Cooperative Education Employment at eight of the agencies in our scope. NSF's science and engineering programs supported 0.2 percent of the students, exclusive of R&D grant funding.

Table 5

1980 Funding for Engineering Education: Student Support (Budget Authority in Thousands)

		Number of Students		
Program Category	1980 Funding	Undergraduates	Graduates	Total
Student Financial Assistance (ED)	$188,571	n.d.	n.d.	146,000
Research and Development Grant Funding (all agencies)	n.d.	n.d.	6,600	6,600
Training in Agency Scientific and Technical Mission-Related Areas (DOC, ED, DOE, DOT, HHS, DOI, EPA, NASA)	12,611	2,162	781	2,943
Federal Cooperative Education Employment Program (Coordinated by OPM) a/	n.d.	1,559	13	1,572
Science and Engineering Education Programs (NSF)	1,828	136	217	353
				157,468

a/Salaries are paid by each participating agency; cumulative totals are not available.

Instructional equipment

Both cross-agency and agency-specific programs provided instructional equipment to engineering schools and departments. These are listed by category in table 6.

Among the cross-agency programs, R&D grants provided nearly $22 million in engineering research equipment to universities in 1980. A significant amount of used Federal property was also provided for research purposes. An unknown portion of this equipment was used for instruction. Available data did not allow precise estimation of its value. (See appendix III for a detailed discussion.)

Table 6

1980 Funding for Engineering Education: Instructional Equipment (Budget Authority in Thousands)

Program Category	1980 Funding
Research and Development Grant Funding	n.d.
Used Federal Property Disposal (GSA, NSF, DOE)	n.d.
Federally Subsidized Academies (DOT)	$4,027
Scientific and Technical Mission-Related Programs (other than academy support) (DOE, DOI)	1,647
NSF Science Education Programs	1,193
Aid to Land-Grant Colleges (USDA, ED)	n.d.

Among agency-specific programs, the largest amount provided for instructional equipment was for federally subsidized academies (i.e., U.S. Merchant Marine and Coast Guard academies and State Maritime schools). The approximately $1.6 million derived from nonacademy agency scientific mission efforts were from three small programs at DOE and DOT, with 52 percent of the total derived from DOE's University Reactor Fuel Assistance Program. A small, unknown portion of land-grant college assistance was expended on instructional equipment. About 46 percent of NSF's contribution of $1.19 million was derived from its Instructional Scientific Equipment Program.

Institutional operation

Institutional operation involves providing funds for the partial or complete operational support of institutions, departments, or units of departments. Three categories of programs provided such support. These are listed in table 7.

Approximately 82 percent of the funds provided for this component of engineering education was expended for support of the Coast Guard, Merchant Marine, and State Maritime academies. An additional 10 percent consisted of Aid to Land-Grant Colleges. Almost all of the remainder was provided to selected institutions through DOI's State Mining and Mineral Resources and Research Institutes Program.

Table 7

1980 Funding for Engineering Education:
Institutional Operation
(Budget Authority in Thousands)

Program Category	1980 Funding
Federally Subsidized Academies (DOT)	$23,198
Aid to Land-Grant Colleges (USDA, ED)	2,894
Scientific and Technical Mission-Related Programs (other than academy support) (DOI, DOT)	2,089
	$28,181

Institutional development

Assistance for this component of engineering education entails initiating or upgrading new or improved educational capacities of higher education institutions over a specific period. Two Federal programs, illustrated in table 8, provided this type of assistance.

Both of these programs had educational objectives. The Comprehensive Assistance to Undergraduate Science Education program of NSF was designed to improve the quality of undergraduate science and engineering instruction by providing funds to institutions of higher education that conducted assessments of instructional needs and carried out comprehensive plans for institutional improvement. The Cooperative Education Program of ED had a number of granting mechanisms that were designed to assist institutions of higher education to develop and operate administrative structures for cooperative education.

Table 8

1980 Funding for Engineering Education: Institutional Development (Budget Authority in Thousands)

Program Category	1980 Funding
Comprehensive Assistance to Undergraduate Science Education (NSF)	$2,140
Cooperative Education Program (ED)	1,725
	$3,865

Curriculum development and dissemination

This category of assistance funds the development and distribution of improved curriculum materials and techniques. As indicated in table 9, less than $3 million was provided for this purpose in 1980.

Table 9

1980 Funding for Engineering Education: Curriculum Development and Dissemination (Budget Authority in Thousands)

Program Category	1980 Funding
NSF Science Education Programs	$2,508
Scientific and Technical Mission-related Programs (DOC, DOE, DOT, EPA)	269
	$2,777

About 90 percent of the funds provided for this component of engineering education was derived from three NSF science education programs that were directed at curriculum or course development across all fields of science. These were Development in Science Education (DISE), Local Course Improvement (LOCI), and Comprehensive Assistance to Undergraduate Science Education (CAUSE). The remainder was provided by five small programs at DOE, EPA, and DOC.

Faculty development

Funds for faculty development are designed to advance professional knowledge and to enrich research and teaching activities at participating institutions. Faculty research participation, workshops, institutes, and conferences are among the vehicles used for this purpose. Two categories of agency-specific programs provided support for this component of engineering education in 1980. These are listed in table 10.

Seventy-five percent of total faculty development funds was provided by programs directed toward agency scientific and technical missions. The largest contributor in this category was NASA's Summer Faculty Fellowship Program, with two small DOE programs making up the balance. The remaining twenty-five percent was provided by two NSF programs that were directed across all fields of science and engineering.

Table 10

1980 Funding for Engineering Education: Faculty Development (Budget Authority in Thousands)

Program Category	1980 Funding
Scientific and Technical Mission-Related Programs (DOE, NASA)	$ 941
Science and Engineering Education Programs (NSF)	322
	$1,263

CHAPTER 3

THE RELATIONSHIP OF FEDERAL ACTIVITIES TO CURRENT CONCERNS ABOUT ENGINEERING EDUCATION

Concerns about engineering education can be organized into two broad categories: concern about the adequacy of the current and future supply of engineers and concern about the condition of the engineering schools. To the extent we could quantify it, we found that most civilian agency support related to the supply of engineers. Much less of that support related to the concern for the condition of engineering schools. Table 11 summarizes our findings about the relationship of Federal activities to these categories of current concern.

THE SUPPLY OF ENGINEERS

Perceived current and future shortages of engineers at both the baccalaureate and advanced-degree levels are at the core of this first area of concern. However, the extent of any existing shortfall is not known, and significant disagreement exists as to whether any future shortfalls will occur. 1/

In our review of Federal support for engineering education, we found no Federal programs designed specifically to increase the overall supply of engineers. There were, however, five Federal activities which, by providing students with support, potentially influenced this supply. These are listed in table 11. We estimated that approximately 157,000 engineering students were supported by these programs in 1980, but no information was available that would have allowed determining how many were undergraduates and how many were graduates. An estimated 146,000 of these (or 93 percent of the total) were beneficiaries of ED's Student Financial Assistance programs. Research and development grant funding supported more than half of the remainder.

THE CONDITION OF THE ENGINEERING SCHOOLS

Three parts of the engineering education system have been subjects of major concern: the supply of engineering faculty, the availability of adequate instructional equipment, and the appropriateness of engineering curricula.

1/Engineering Education for the 1980s, p. 34 and pp. 40-50. See also: Bureau of Labor Statistics, U.S. Department of Labor, Occupational Projections and Training Data, 1980 Edition, Bulletin 2052 (Washington, D.C., 1980), p. 55; and National Science Foundation, Projections of Science and Engineering Doctorate Supply and Utilization, 1982 and 1987 (Washington, D.C., 1979), p. 15.

Table 11

1980 Funding For Engineering Education By Area of Concern (Budget Authority in Thousands)

Area of Concern	Funding
Supply of Engineers	
Student Financial Assistance (ED)	$188,571
Student Support through R&D Grant Funding (all agencies)	n.d.
Training Support in Scientific and Technical Mission-Related Areas (DOC, ED, DOE, HHS, DOI, DOT, EPA, NASA)	12,611
Federal Cooperative Education Employment Program (coordinated by OPM) a/	n.d.
Science and Engineering Education Programs (NSF)	1,828
Condition of Engineering Schools	
Faculty Supply	
Doctoral Student Support	
Student Financial Assistance (ED)	n.d.
R&D Grant Funding (all agencies)	n.d.
Training Support in Scientific and Technical Mission-Related Areas	n.d.
Graduate Fellowships Programs (NSF)	1,130
Faculty Development Support (DOE, NASA, NSF)	1,263
Instructional Equipment	
Instructional Equipment Provided by R&D Grant Funding	n.d.
Used Federal Property Disposal (GSA, NSF,DOE)	n.d.
Federally Subsidized Academies (DOT)	4,027
Science and Engineering Education Programs (NSF)	1,193
Scientific and Technical Mission-Related Programs (other than academy support) (DOE, DOI)	1,647
Aid to Land-Grant Colleges (USDA, ED)	n.d.
Curriculum Development	
Curriculum Development Support (DOT, DOE, EPA, NSF)	2,777

a/Salaries are paid by each participating agency; cumulative totals are not available.

Engineering faculty supply

There is widespread concern about a perceived current shortage of engineering faculty. Conclusive data regarding this perceived shortfall were not available, but estimates are in the 1,800 1/ to 2,000 range, 2/ or about 10 percent of the total number of engineering faculty.

In our review, we found that the Federal Government did not have any programs specifically designed to produce engineering faculty or to provide direct subsidies for people studying expressly to become faculty members. However, two kinds of Federal activity may have an effect in this area--doctoral student support and faculty development programs.

Federal programs that provided support for doctoral students may have some effect on the faculty supply because some students who reach this level of education become faculty members. (A National Research Council survey found that approximately 30 percent of persons awarded engineering Ph.D.s in academic year 1979 planned employment in academia.) 3/ Student Financial Assistance programs, Federal R&D funding, mission agency training programs, and NSF graduate fellowships all provided support to doctoral engineering students.

Graduate students are eligible for assistance in most financial assistance programs, except Pell grants and SEOG. However, lack of data precluded us from determining how many graduate students generally, or doctoral students specifically, received support. As for R&D funding, it was impossible to determine precisely how many of the approximately 6,600 engineering students involved eventually obtained Ph.D.s. The same imprecision applies to the approximately 781 graduate students supported in mission agency training programs. By contrast, NSF program officials estimated that 70-75 percent of the approximately 217 engineering students

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1/Donald D. Glower, et al., "A Program for Producing More Engineering Doctorates to Meet National Needs for Productivity and Innovation" (Draft, 1980), p. 1.

2/Engineering Education for the 1980s, p. 71. See also: American Society for Engineering Education/American Association of Engineering Societies, "Memorandum on Engineering Education" (Washington, D.C., 1980), p. 5, and Daniel C. Drucker and Guyford H. Stever, Statements Before the Subcommittee on Science, Research, and Technology of the Committee on Science and Technology, U.S. House of Representatives, relative to NSF Authorization for 1982, pages 3 and 2, respectively.

3/National Research Council, National Academy of Sciences, Summary Report, 1979; Doctoral Recipents from United States Universities (Washington, D.C., 1980), p. 21.

that participated in their Graduate Fellowship Program eventually obtained Ph.D.s.

Federal funding may also influence faculty supply through activities that stimulate the professional development of present faculty members. Such programs help to retain faculty who may otherwise abandon academia for better career opportunities in the industrial sector. In 1980, five programs at three agencies (NASA, DOE, and NSF) provided funding to support faculty development.

Instructional equipment

Several recent reports and congressional testimony by engineering educators and others in the field have stressed obsolete instructional equipment as a major problem confronting engineering education. The extent of need for equipment is not precisely known; however, available estimates of equipment replacement needs range from $750 million 1/ to more than $1 billion. 2/

No Federal programs that existed in 1980 were specifically designed to provide instructional equipment for engineering. However, as we have previously shown, significant amounts of such equipment, both new and used, have been provided annually. (See chapter 2, pages 19 and 20 for a description of the Federal effort in this area.) Eleven agency-specific programs provided approximately $6.9 million in instructional equipment in 1980, with 59 percent of this amount going to federally subsized academies. R&D funding and used equipment donation also contributed to some extent, but data on these efforts are not collected on a sufficiently detailed level to allow the amount of engineering instructional equipment they provided to be estimated (see appendix III for further details).

Engineering curricula

Another part of the engineering education system that has been the subject of much debate is engineering curricula. Interested parties have focused their discussion on two issues: whether curricula are sufficiently up-to-date 3/ and whether curricula are

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1/Donald D. Glower, "Concerns for the Future of Engineering Education." (Unpublished paper prepared for the Special Task Group for the ED and NSF Presidential Review of Science and Engineering Education, April 1980), p. 1.

2/Daniel C. Drucker, "Statement," p. 8.

3/John M. Logsdon, ed., "The Research System in the 1980's: Public Policy Issues." (Philadelphia: Franklin Institute Press, 1982), "Engineering, The Neglected Ingredient," by Karl F. Willenbrock, (unpublished paper, March 16, 1981), p. 20.

properly oriented toward industrial interests. 1/ The latter issue has prompted disagreement about whether engineering curricula should have a more pragmatic focus or concentrate more on engineering science.

Seven small agency-specific programs supported curriculum development in engineering, with most of the funding provided by three NSF programs. (See the previous discussion in chapter 2.) One of these, the Development in Science Education program, awarded a grant of $306,000 in 1980 to support the formation of a national consortium of universities and industries dedicated to modernizing the engineering and applied sciences curricula for the 1980s.

1/National Academy of Engineering, Issues in Engineering Education: A Framework for Analysis (Washington, D.C., 1980), pp. 39-42.

CHAPTER 4

CHANGES IN SUPPORT FROM FISCAL YEAR 1980 TO FISCAL YEAR 1982

The third and final purpose of this report is to describe changes made by the FY 1982 budget in the character and level of Federal involvement in engineering education. Remember, the 1982 funding information presented reflects the most current information available as of September 15, 1981. Changes that have occurred since that date are not reflected in these conclusions. However, the recent changes do not indicate a substantially different pattern of Federal support than we have described here.

1982 CHANGES BY SOURCE OF SUPPORT

Of the 35 agency-specific Federal programs that we identified as affecting engineering education in 1980, 13 could be terminated in 1982. (See table 12 for a list of these programs.) Overall assistance from these programs could decline 28.2 percent, not including the Student Financial Assistance Program.

The Student Financial Assistance Program's budget authority in 1980 was nearly four times larger than all other agency-specific programs combined. Thus, changes in funding for this program tend to overshadow even major changes in others. If we include the 1982 increase for student assistance outlays in a summary calculation, total assistance rises 11.8 percent.

We did not add the three cross-agency activities to the agency-specific programs. The funding information for the cross-agency programs was not detailed or precise enough to total. We can, however, give some general information about proposed changes in these programs. They are included in tables where appropriate.

The changes from 1980 funding levels for each source of support are illustrated in table 13. Detailed information by program is provided in appendixes I and IV. Upon viewing the table, one can see that three agencies' support for engineering education could be terminated, two could receive a reduction in funding, and four could have their funding levels increased.

The agencies that could have their engineering education funds eliminated are the Departments of Agriculture and the Interior and the Environmental Protection Agency. The funding reduction in HHS is due mainly to the elimination of institutional allowances and indirect costs for schools participating in the predoctoral training grants portion of the National Research Service Awards program. The other agency slated for a reduction in funds is NSF since most of its Science and Engineering Education Directorate programs may be terminated in 1982. Sufficient funds may be retained only for the Graduate Fellowship Program to continue previously awarded fellowships.

Table 12

Program Termination: 1982

Agency	Program
USDA	Aid to Land-Grant Colleges (Bankhead-Jones)
ED	Aid to Land-Grant Colleges (Morrill-Nelson)
	Domestic Mining and Mineral and Mineral Fuel Conservation Fellowship Program a/
DOI	State Mining and Mineral Resources and Research Institutes Program
EPA	Air Pollution Traineeship Program
	Academic Grants in Solid Waste Technology
	Academic Training Program in Water Pollution Control a/
NSF	Development in Science Education (DISE)
	Comprehensive Assistance to Undergraduate Science Education (CAUSE)
	Instructional Scientific Equipment Program (ISEP)
	Local Course Improvement (LOCI)
	Science Faculty Programs
	Undergraduate Research Participation (URP)

a/Funding for these programs was also rescinded for FY 1981.

Table 13

Funding For Engineering Education By Source a/
1982 Changes
(Budget Authority in Thousands)

Agency	1982 Funding	Change from 1980 level	
		Dollars	Percent
Agency-Specific Programs			
Department of Agriculture	$ 0	-$ 2,300	-100.0%
Department of Commerce	n.d.	n.d.	n.d.
Department of Education	233,483	+ 39,514	+ 20.4
Department of Energy	2,268	+ 470	+ 26.1
Department of Health and Human Services	1,082	- 261	- 19.4
Department of the Interior	0	- 7,200	-100.0
Department of Transportation	25,115	+ 1,360	+ 5.7
Environmental Protection Agency	0	- 579	-100.0
National Aeronautics and Space Administration	4,678	+ 2,305	+ 97.1
National Science Foundation	1,258	- 5,120	- 80.3

a/Cross-agency programs are not included because adequate data were not available.

The increase in ED's funds is caused by the possible 23 percent increase in the Student Financial Assistance Program. DOE and NASA could also have their funding levels increased in 1982. DOT's funding could rise because of a 7.5 percent increase in support for academies. This will more than offset the decline of 69.3 percent in Highway Technology and Safety. (See table 14, p. 32.)

1982 CHANGES BY OBJECTIVE OF SUPPORT

Changes in funding for programs that were directed at educational objectives or at the scientific and technical missions of Federal agencies are displayed in table 14. Detailed information by program is available in appendix IV.

Table 14

Funding For Engineering Education By Objective
1982 Changes
(Budget Authority in Thousands)

Objectives	1982 Funding	Change from 1980 level Dollars	Change from 1980 level Percent
Education			
Science and Engineering Education Programs (NSF)	$ 1,258	-$ 5,120	- 80.3%
Aid to Instruction at Land-Grant Colleges (USDA, ED)	0	- 2,894	-100.0
Cooperative Education (ED)	2,300	+ 575	+ 33.3
Student Financial Assistance (ED)	231,183	+ 42,612	+ 22.6
Federal Cooperative Education Employment Program (coordinated by OPM)	n.d.	n.d.	n.d.
Surplus Federal Property Donation (GSA)	n.d.	n.d.	n.d.
Scientific and Technical Missions			
Aeronautics/Space (NASA)	4,678	+ 2,305	+ 97.1
Biomedical and Behavioral Science (ED, HHS)	1,082	- 365	- 25.2
Energy (DOE)	2,268	+ 470	+ 26.1
Environmental Protection (EPA)	0	- 579	-100.0
Highway Technology and Safety (DOT)	171	- 386	- 69.3
Maritime Transportation and Safety (DOT)	24,944	+ 1,746	+ 7.5
Mining and Minerals (ED, DOI)	0	- 10,175	-100.0
Marine Resources (DOC)	n.d.	n.d.	n.d.
R&D Grant Funding (all agencies)	n.d.	n.d.	n.d.
Used Federal Property Disposal (NSF, DOE)	n.d.	n.d.	n.d.

Among the programs directed at educational objectives, the 23 percent scheduled increase in student financial assistance should not obscure the proposed termination of both land-grant assistance programs and the near elimination of NSF's science and engineering education programs. Participation in the Federal Cooperative Education Employment Program may decline in 1982 because of the Government's conversion to a full-time equivalency personnel accounting system in which hours worked by co-op students are counted against an agency's total allocation for permanent employees. The full effect of such a change is not yet known.

In 1982, funding from programs that supported engineering education while furthering agency scientific and technical missions may decline in most areas, with three exceptions. Aeronautics and space- and energy-related fields of engineering may be the beneficiaries of significantly higher funding levels, while funding for federally subsidized academies may remain about the same.

1982 CHANGES BY TARGET OF SUPPORT

Changes in funding from 1980 to 1982 for support to various parts of the engineering education system are illustrated in table 15. Detailed information by program is presented in appendix IV.

Table 15

Funding for Engineering Education by Targets of Support a/
1982 Changes
(Budget Authority in Thousands)

Target of Support	1982 Funding	Change from 1980 level Dollars	Percent
Student Support	$243,500	+$40,490	+19.9
Instructional Equipment	4,435	- 2,432	-35.4
Institutional Operation	24,944	- 3,237	-11.5
Institutional Development	2,300	- 1,565	-40.5
Curriculum Development and Dissemination	65	- 2,162	-97.4
Faculty Development	949	- 314	-24.9

a/Because adequate data were not available, this table does not include changes in support provided by cross-agency programs. Proposed changes in these programs are discussed in the text.

The display of funding by target of support reinforces the disparity between funding from student financial assistance and all other agency-specific programs. Funding could rise for student support but decline significantly in all other areas.

According to the American Association for the Advancement of Science, civilian agency R&D funding requested for 1982 is about 9 percent higher than 1980 funding. 1/ In constant dollars, however, funding declines by 7.6 percent over the 2-year span. The implications of this change for the number of students supported by R&D funds are not known.

Many of the programs providing assistance for other components of engineering education could be terminated. Almost 100 percent of the funds that may remain in the institutional operation and instructional equipment categories are expenditures for federally subsidized academies.

The volume of instructional equipment that was made available to engineering schools via donations of used Federal property is not a function of individual program funding decisions. It is, rather, a product of the amounts of excess property generated government-wide and this property's usefulness to instructors. The difficulty of predicting this product, combined with the imprecision of data available for past years, made it impossible to make any statement about changes from 1980 to 1982. Neither was it possible to predict the amount of instructional equipment that will be provided by R&D funds in 1982.

1982 CHANGES BY AREA OF CONCERN

Table 16 illustrates the change in funding for each area of concern from 1980 to 1982.

In the first of two broad areas of concern--engineer supply--overall 1982 support for engineering students could rise significantly because of possible increases in student financial assistance. Other sources of student support may decline, however. As we mentioned in our initial discussion (see p. 10), funding for student financial assistance is not equivalent to the volume of assistance actually provided to students. Although funding is slated for only a 23 percent increase from 1980 to 1982, the actual volume of assistance received is likely to go up about 52 percent over the 2-year period.

Most of this increase is due to the rise in borrowing that may take place in the Guaranteed Student Loan program. Slightly more stringent terms have been imposed for student borrowing in 1982, and Department of Education officials expect that borrowing in this portion of GSL may decline slightly as a result. However, greatly increased borrowing under the new Auxiliary Loans to Assist Students program is expected to more than offset this trend. Total

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1/Willis Shapley.

Table 16

Funding for Engineering Education by Area of Concern
1982 Changes
(Budget Authority in Thousands)

	1982	Change from 1980 level	
Area of Concern	Funding	Dollars	Percent
Supply of Engineers			
Student Financial Assistance (ED)	$231,183	+$42,612	+ 22.6%
Student Support through R&D Grant Funding (all agencies)	n.d.	n.d.	n.d.
Training Support in Scientific and Technical Mission-Related Areas (DOC, ED, DOE, HHS, DOI, DOT, EPA, NASA)	11,059	- 1,552	- 12.3
Federal Cooperative Education Employment Program (coordinated by OPM)	n.d.	n.d.	n.d.
Science and Engineering Education Programs (NSF)	1,258	- 570	- 31.2
Condition of Engineering Schools			
Faculty Supply			
Doctoral Student Support: Student Financial Assistance	n.d.	n.d.	n.d.
R&D Grant Funding	n.d.	n.d.	n.d.
Training Support in Scientific and Technical Mission-Related Areas	n.d.	n.d.	n.d.
Graduate Fellowship Programs (NSF)	912	- 218	- 19.3
Faculty Development Support (DOE, NASA, NSF)	949	- 314	- 24.9
Instructional Equipment			
R&D Grant Funding	n.d.	n.d.	n.d.
Used Federal Property Disposal (GSA, NSF, DOE)	n.d.	n.d.	n.d.
Federally Subsidized Academies (DOT)	3,617	- 410	- 10.2
Science and Engineering Education Programs (NSF)	0	- 1,193	-100.0
Scientific and Technical Mission-Related Programs (other than academy support) (DOE, DOI)	818	- 829	- 50.3
Aid to Land-Grant Colleges (USDA, ED)	0	n.d.	-100.0
Curriculum Development			
Curriculum Development Support (DOC, DOT, DOE, EPA, NSF)	65	- 2,162	- 97.1

GSL loan volume is expected to rise to about $9.5 billion in 1982 from a level of $4.84 billion in 1980.

In 1982, training support in scientific and technical missions could decline by about 12.3 percent due mainly to termination of five programs that provided such support. NSF's funding could decline by about one-third due to the planned phase-out of graduate fellowships and termination of the Undergraduate Research Participation program.

The second major area of concern is the condition of the engineering schools. One can see from table 16 that funding for each subcategory of this concern could be substantially reduced in 1982. A possible exception is faculty supply. Increased student financial assistance for doctoral students may balance out reductions in other contributors. Agency-specific funding for instructional equipment, excluding academy support, may decrease by 71 percent. Curriculum development funding could be almost completely eliminated.

CHAPTER 5

CONCLUSIONS

We have presented an overview of Federal civilian agency support for engineering education that describes

--the size and scope of Federal assistance,
--its relationship to current concerns in this area, and
--the changes that could be effected by the FY 1982 budget.

We found that engineering education in 1980 was supported by 38 programs at 11 agencies, although none were primarily intended to advance engineering education. Instead, they provided assistance while furthering two other broad objectives: (1) support for education in general or science education in particular or (2) advancement of agency scientific and technical missions. About $240 million was provided by 35 agency-specific programs, with the preponderance of support derived from Student Financial Assistance and aid to the three federally subsidized academies. Together, the 31 remaining agency-specific programs provided only $28 million.

To the extent that we could quantify funding, we found most Federal support related to the current concern about the supply of engineers rather than to the concern about the condition of the engineering schools. This disparity was due primarily to Student Financial Assistance providing nearly four-fifths of all agency-specific funding.

Although funding levels for individual programs may change in fiscal year 1982, this will not alter the overall pattern of Federal support for engineering education. It will continue to be indirectly provided through many programs and dominated by Student Financial Assistance. This large program could increase by 23 percent, causing overall funding to rise to $268 million. At the same time, 13 of the other agency-specific programs could be terminated, leaving 21 programs to provide less than $37 million in aid. The 3 programs for federally subsidized academies may receive $25 million of this amount. The net result is that Student Financial Assistance and aid to federally subsidized academies may make up an even higher percentage of total funding than was previously the case.

Total Federal funding related to the concern about the supply of engineers may increase, primarily because of the rise in Student Financial Assistance. This increase, combined with a decline in funding related to concern for the condition of engineering schools, could cause a greater disparity between the two areas of concern.

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DESCRIPTION OF AGENCY-SPECIFIC PROGRAMS

DEPARTMENT OF AGRICULTURE

Name

Aid to Land-Grant Colleges
(Bankhead-Jones)

Organizational location

Science and Education
Office of Higher Education

Legislative mandate

Morrill Act of 1862, as amended, 7 U.S.C. 301 et seq.; Second Morrill Act of 1890, as amended, 7 U.S.C. 322 and 323; Bankhead-Jones Act as amended, 7 U.S.C. 329; Food and Agriculture Act of 1977, 7 U.S.C. 3152. The Bankhead-Jones Act states that its purpose is "to provide for the more complete endowment and support" of land-grant colleges.

Objective

To endow and maintain land-grant colleges, specifically for instruction in agriculture, the mechanic arts, the English language, and the various branches of mathematical, physical, natural, and economic science.

History

Funds were first appropriated and distributed in 1936, pursuant to passage of the Bankhead-Jones Act in 1935. The funding level reached $2.48 million in 1939 as prescribed by that legislation, was increased slightly in 1954, and remained level until 1961. In 1960, the Congress amended the Act (Public Law 86-658), increasing the uniform grants to each State or territory from $20,000 to $150,000 and the variable sum to be distributed by population from $1.502 million to $4.3 million. This increase was implemented in order to restore the level of support authorized in 1935 by compensating for the effects of inflation and population growth. Funding was increased to $11,500,000 in 1977. The Food and Agriculture Act of 1977, Public Law 95-113, transferred administration of this program from HEW to USDA.

Description

USDA allocates funds in two ways to 54 States and territories that have a total of 71 land-grant institutions. 1/ First, $8.1

1/These numbers rise to 56 and 73, respectively, with the addition of American Samoa and Micronesia in 1982.

million is divided equally among eligible States and territories. Second, $4.3 million is divided according to population. Total amounts per State in 1980 varied from $151,031 to $479,252. A 1980 review [1] of the program reported that approximately 80 percent of this aid was expended on faculty salaries, with the remainder going to instructional equipment, faculty and curriculum development, and other miscellaneous activities.

Funding

fiscal year	(in thousands)
1978 (actual)	$11,500
1979 (actual)	11,500
1980 (actual)	11,500
1981 (estimate)	11,500
1982 (request)	0

Percentage engineering education

According to the 1980 program review, 28 percent of Bankhead-Jones funds was devoted to engineering education in 1979. By 1980, however, this figure had declined to approximately 20 percent. The change can be attributed to congressional direction concerning use of Bankhead-Jones funding, as expressed in House Report 96-1095, which stated "The Committee . . . expect[s] that, to the maximum extent possible, these grants [will] be used only in support of agricultural education."

Comments

Funding has been requested for this program only twice during the past decade. Nevertheless, the Congress has supplied funding each year. According to the 1980 review of the program, the major arguments against continued funding have included the following: the program is an insignificant source of aid, it is inequitable because it reaches only land-grant schools, funds cannot be targeted for special needs, and it is not in line with the shift in Federal education policy toward individual assistance and away from institutional aid.

Those in favor of this aid stress the need for funds on the part of land-grant schools and the desirability of providing assistance to these institutions, upon which the Nation relies for a large portion of its educated work force and which extend their benefits to a relatively broad segment of the population.

---

[1] U.S. Department of Agriculture, Science and Education Administration, Review of the Bankhead-Jones Program: Final Report, August 1980.

DEPARTMENT OF COMMERCE

Name

Sea Grant Marine Education

Organizational location

National Oceanic and Atmospheric Administration
Research and Development Office
National Sea Grant College Program

Legislative mandate

The Sea Grant Program Improvement Act of 1976, 33 U.S.C. 1121 *et seq*. Previous authority, the National Sea Grant College and Program Act of 1966, Public Law 89-688, was superseded by this Act. The Act states

> The Secretary [of Commerce] may make grants and enter into contracts . . . to assist any sea grant program or project if the Secretary finds that such program or project will
>
> (1) implement the objective set forth [below]; and
>
> (2) be responsive to the needs or problems of individual States or regions.

Objective

To increase the understanding, assessment, development, utilization, and conservation of the Nation's ocean and coastal resources by providing assistance to promote a strong educational base, . . . research and training activities, and . . . dissemination of knowledge and techniques.

History

The Office of Sea Grant (OSG) was established within the National Science Foundation in 1967 upon passage of the National Sea Grant College and Program Act of 1966. It was transferred to the National Oceanic and Atmospheric Administration upon its creation in 1970. Sea Grant's first awards were made in 1968 at a funding level of approximately $5 million.

Sea Grant's growth since that time can be measured by the number of institutions designated as Sea Grant Colleges, signifying demonstrated superior performance in each of the three main elements of the Sea Grant process: education and training, research, and advisory services. The first four such institutions were named in 1971. There are currently 16, with 11 more participating at the institutional or coherent project level. (See description.)

At its inception, Sea Grant's Marine Education element concentrated on development of specialists with skills for marine careers. This task still absorbs the majority of education funds. The 1976 Act created a Sea Grant Fellowship program to advance this purpose. Marine education's scope has been broadened over the past 15 years to include other types of activity. Recently, for example, significant effort has been directed toward introducing marine affairs into instruction at all grade levels to increase marine literacy.

Description

Sea Grant provides matching funds on a 2:1 basis for activity in three broad elements: education, research, and advisory services. Funds are distributed across many academic fields, including engineering, biology, law, and business, which address Sea Grant objectives. There are two general award types: institutional grants and project grants. The majority of funds is distributed in institutional grants of two types: "Institutional" or "Coherent Project" grants. The former are awarded to institutions of higher education that are close to achieving the level of competence necessary for "Sea Grant College" status, while the latter are for less extensive programs. These grants are awarded for specific programs that are made up of numerous individual projects. Local Sea Grant Directors make the initial selection among competing projects. The resulting proposal is closely reviewed by OSG. One hundred and seventy-six institutions of higher education currently receive funding in this manner through the 27 State-designated Sea Grant institutions. A smaller amount of funding is expended on project grants to individuals for discrete short-term efforts (usually one year) that address Sea Grant objectives in some way.

As previously indicated, institutions plan their own participation in Sea Grant. Funds are not normally awarded on a project-by-project or element-by-element basis, but rather for a complete program. Statistics are available, however, as to the amount of funding awarded in each of the three main elements. In 1980, about 10 percent of the total program appropriation of $38.7 million was devoted to marine education.

Tabulations of grantee educational activity are maintained in eight categories. Five of these involve precollege, informal or technical education and thus lie outside of our scope. The three remaining activities contain projects that affect engineering education. They are

--college-level and graduate-level course development efforts: Projects in this category involve the development or revision of courses or curricula in fields concerning marine resources. In 1980, 27 projects were funded at a cost of approximately $563,000.

--research assistantships and internships: Projects in this category provide support for graduate students in appropriate fields. In 1980, 11 projects were funded at a cost of approximately $740,000. The amount provided per student varied.

--sea grant fellowships: Projects in this category provide support for both undergraduate- and graduate-level students in appropriate fields, particularly, but not exclusively, to persons who would not otherwise be involved in marine resource activities, including women, minorities, and the handicapped. Fellows are selected by grantees, not by OSG. Support per student varies. In 1980, nine projects were supported at a cost of approximately $261,000.

Funding

fiscal year	(in thousands)
1978 (actual)	$1,748
1979 (actual)	1,771
1980 (actual)	1,563
1981 (estimate)	N/A
1982 (request)	N/A

These figures include only the portions of marine education that are devoted to course development, research assistantships and internships, and Sea Grant Fellowships. (See "Description.")

Percentage engineering education

College-level and graduate-level course development efforts

Five of the 27 projects funded in 1980 were in marine, coastal or ocean engineering, involving 9.6 percent of funds.

Research assistantships and internships and Sea Grant Fellowships

Statistics are not maintained on the numbers of students involved in these projects (nor of their majors). It is therefore impossible to estimate the percentage of student engineers.

Due to the lack of data in two of these three categories, it is not possible to estimate the overall percentage of these activities devoted to engineering education.

Comments

The 1982 NOAA budget submission called for the termination of Sea Grant by 1983. No new grants will be made in 1982, with $1.2 million to be provided for administration of previously committed funds only. In 1983, $1.8 million would be provided to close down entirely.

DEPARTMENT OF EDUCATION

Name

Aid to Land-Grant Colleges
(Morrill-Nelson)

Organizational location

Office of Postsecondary Education
Office of Higher and Continuing Education
Student Services and Veteran's Programs Division
Veterans' Programs Branch

Legislative mandate

Second Morrill Act of 1890, as amended, 7 U.S.C. 322, 323. The Act states that these funds are "to be paid . . . to each State and Territory for the more complete endowment and maintenance of colleges for the benefit of agriculture and the mechanic arts . . ." (i.e., land-grant colleges).

Objective

To support instruction at land-grant colleges in agriculture; the mechanic arts; the English language; and the various branches of mathematical, physical, natural, and economic science, with special reference to their applications in the industries of life and to the facilities for such instruction.

History

This appropriation was designed to provide additional monies for the support of land-grant colleges that had been established under the first Morrill Act of 1862 (12 Stat. 503, 7 U.S.C. 301). It provided an annual payment of $25,000 to each State or territory with such an institution. The Nelson Amendment of 1907 doubled the amount per State or territory to $50,000.

Description

The Secretary of Education annually distributes $50,000 to each State or territory having a land-grant college. Fifty-six States and territories with 74 land-grant institutions among them receive this aid. A 1980 review 1/ of the program reported that 90 percent of these funds were used for faculty salaries. The remainder is expended on instructional equipment, guest faculty, curriculum development, and other miscellaneous activities.

1/U.S. Department of Agriculture, Science and Education Administration, Review of the Bankhead-Jones Program: Final Report, August 1980.

Funding

fiscal year	(in thousands)
1978 (actual)	$2,700
1979 (actual)	2,700
1980 (actual)	2,700
1981 (estimate)	2,800
1982 (request)	0

Funding increased in 1981 by $100,000 as American Samoa and Micronesia were included for the first time by the Education Amendments of 1980, Public Law 96-374.

Percentage engineering education

According to the 1980 program review, 22 percent of program funds were expended in engineering education in 1979.

Comments

Zero funding has been requested for this program on several occasions during the past decade, but the Congress has provided funding each year nevertheless. According to the 1980 review of the Bankhead-Jones and Morrill-Nelson programs, the major arguments against continued general purpose funding for land-grant institutions included the following: the program is an insignificant source of aid, it is inequitable because it reaches only land-grant schools, funds cannot be targeted for special needs, it is not in line with the shift in Federal education policy toward individual assistance and away from institutional aid.

Those in favor of this aid stress the desirability of providing assistance to land-grant institutions, upon which the Nation relies for a large portion of its educated workforce and which extend their benefits to a relatively broad spectrum of the population.

Name

Cooperative Education Program

Organizational location

Department of Education
Office of Postsecondary Education
Office of Institutional Support Programs
Division of Institutional and State Incentive Programs
Cooperative Education Branch

Legislative mandate

Higher Education Act of 1965 (Title VIII), Public Law 89-329, as amended by Public Law 90-575, October 16, 1968; Public

Law 92-318, June 23, 1972; Public Law 94-482, October 12, 1976; and Public Law 96-374, October 3, 1980, 20 U.S.C. 1133. The legislation states that grants shall be made for "planning, establishing, expansion, or carrying out programs of cooperative education" which provide alternating or parallel periods of academic study and related employment.

Objective

To enrich the quality and scope of postsecondary education through educationally related work experiences that afford students an opportunity to earn funds needed for their education, while enabling them to become better prepared to achieve their educational or career objectives.

History

Cooperative education was introduced in 1906 at the University of Cincinnati when engineering students were found to be inadequately prepared to begin work immediately upon graduation. The Higher Education Amendments of 1968 (Public Law 90-575) began significant Federal sponsorship of university cooperative education programs. These amendments authorized the Office of Education to provide aid to institutions of higher education to develop cooperative education programs in conjunction with public and private employers. The Act also authorized expenditure of funds for administration, training, and research (see description). The legislation was amended in 1972 to allow for demonstration projects, but none were funded until 1979. The 1976 amendments established a separate Title VIII within the Higher Education Act for cooperative education. Priority funding was given to programs with a high receptivity for placing students in appropriate jobs and institutional commitment to continue after Federal support stopped.

Funding was first provided in 1970, at a level of $1.54 million for 74 awards. It was increased in 1973 to $10.75 million, and from $15 to $23 million in 1981. The most recent funding increase was absorbed in a greater emphasis on demonstration grants, coupled with a decline in administration grant funding.

Description

There are four components in this program:

--administration grants: These are made on a proposal basis to institutions of higher education to develop and carry out cooperative education programs. They are generally for the use of one department or a cluster of departments. Federal funds may provide 100 percent of costs the first year, but support declines in regular intervals to 30 percent the fifth year. In 1980, 251 projects were supported at an average cost of $47,800.

- --demonstration grants: These are larger grants that are made to institutions of higher education to help them plan and initiate institution-wide programs. These awards cover the full life of the project, which is generally 3 years. They are designed to test the feasibility of broad cooperative education projects and to discover more effective structures for their operation. Three demonstration projects were supported in 1980 at an average cost of $666,667. In both administration and training grants, administrative salaries and related expenses are payable from grant funds. Student salaries are paid by employers and not by the participating school.

- --research grants: These are given to institutions of higher education or to other nonprofit institutions to conduct research on methods of improving, developing, or promoting the use of cooperative education. In 1980, four grants were awarded with an average cost of $53,000.

- --training grants: These are awarded to institutions of higher education and other nonprofit organizations to train prospective cooperative education program planners or administrators. In 1980, 14 such grants were made at an average cost of $56,200.

Funding

fiscal year	(in thousands)
1978 (actual)	$15,000
1979 (actual)	15,000
1980 (actual)	15,000
1981 (estimate)	23,000
1982 (request)	20,000

Percentage engineering education

According to program officials, about 11.5 percent of the 68,768 students participating in cooperative education programs that received Federal assistance in 1980 were engineering majors.

Name

Domestic Mining and Mineral and Mineral Fuel Conservation Fellowship Program

Organizational location

Department of Education
Office of Postsecondary Education
Office of Institutional Support
Facilities and General Support Programs Division
Graduate Training Branch

Legislative mandate

Title IX, Part B of the Higher Education Act of 1965, Public Law 89-329, as amended by the Education Amendments of 1972 (Public Law 92-318), of 1976 (Public Law 94-482), and of 1980 (Public Law 96-374), 20 U.S.C. 1134(d) et seq. The purpose of the legislation is "to assist graduate students of exceptional ability who demonstrate a financial need for advanced study in domestic mining and mineral and mineral fuel conservation including oil, gas, coal, oil shale, and uranium . . . ."

Objective

To provide trained personnel to improve technologies for efficient extraction and processing of nonrenewable minerals and mineral fuels, to protect the health and safety of people working in the industry, to protect and restore the environment, and to ensure the availability of nonrenewable minerals and mineral fuels, including exploration, discovery, and recycling.

History

This program was a congressional initiative. Funding was initiated in 1975 at a level of $1.5 million and increased to $4.5 million by 1977. Until 1979, 1-year, renewable awards were generally given. In that year, however, the Department began awarding 2-year fellowships so that the program could be terminated in 1981 without adversely affecting student participants.

Description

Allocations of fellowships are competitively awarded by the Department to institutions of higher education. Successful applicants then select student recipients. Fellowships may be renewed for up to 36 months of study but the usual duration is about 18 months. Stipends are set at $4,500 per year, with an associated $3,900 institutional allowance. Current law specifies that the Secretary of Education is to assure that the amount expended for fellowships in succeeding years is not less than that expended in 1979. In 1980, 321 students participated in the program. Studies at both the M.S. and Ph.D. levels are funded; 75 percent of the students pursue a master's degree.

Funding

fiscal year	(in thousands)
1978 (actual)	$4,500
1979 (actual)	4,500
1980 (actual)	4,500
1981 (estimate)	0
1982 (request)	0

Percentage engineering education

According to a survey of the participating students in 1980, 66.1 percent were engineering majors.

Comments

Since their inception, the Congress and the Administration have disagreed over the need for these fellowships. Congressional support has been based on a perceived national need for personnel to develop mineral resources to respond to increasing needs and a corresponding undesirable dependence on foreign sources. While recognizing this need, the Administration has not recognized the necessity for Government involvement. Their perception has been that the relatively high financial reward for employment in these fields is sufficient incentive to draw an adequate number of students. Funding at a level of $1.15 million was initially approved for 1981 but was later rescinded.

Name

Rehabilitation Engineering Traineeship Program

Organizational location

Department of Education
Office of Special Education and Rehabilitative Services
Rehabilitation Services Administration
Office of Developmental Programs
Division of Resource Development
Experimental and Innovative Training Program

Legislative mandate

Rehabilitation Act of 1973, Sections 203 and 304; Public Law 93-112, as amended by Public Law 93-516, Public Law 94-230, and Public Law 95-602 (29 U.S.C. 701 et seq.). The legislation states

> [The Secretary] may make grants . . . to pay part of the cost of projects for training, traineeships, and related activities designed to assist in increasing the numbers of personnel trained in providing . . . rehabilitation services to handicapped individuals.

Objective

The Experimental and Innovative (E&I) Training Program has two objectives: to improve methods of training for rehabilitation personnel and to develop new types of rehabilitation professionals.

The objective of this particular project within the E&I Training Program is to determine the feasibility and usefulness of this training program for rehabilitation engineers, thereby contributing to more expeditious delivery of vocational rehabilitation services.

History

In 1976 and 1977, the Rehabilitation Services Administration (RSA) and the Veterans Administration sponsored a series of 10 workshops to develop plans for program development in rehabilitation engineering. This effort was undertaken in order to update the previous plan, which had been in existence since 1971. One of the major recommendations of the conference on education was initiation of a pilot program in graduate-level rehabilitation engineering education. RSA solicited proposals and awarded a 5-year grant for this purpose to the University of Virginia in 1979. The first five students enrolled in the fall of 1979, with nine more joining them in 1980.

Description

The RSA grant to the University of Virginia provides matching funds on a 4:1 basis for a 5-year demonstration project in rehabilitation engineering education. The program of study lasts 2 years and leads to an M.S. degree. It is a dual track program; students with clinical science backgrounds are provided with engineering training and vice versa. Both tracks are intended to produce professionals able to develop, provide, and maintain technical devices and services needed by the handicapped. Ten students per year are supported by traineeships with a stipend of $3,900 plus tuition and fees. Total enrollment in the program was expected to rise to 17 students in 1981. About 54 percent of funds are used for student support, 38 percent for faculty support, and 8 percent for miscellaneous expenses, such as teaching and student project supplies.

Funding

fiscal year	(in thousands)
1978 (actual)	$ --
1979 (actual)	87
1980 (actual)	104
1981 (estimate)	125
1982 (request)	N/A

Percentage engineering education

This program is devoted entirely to engineering education.

DEPARTMENT OF ENERGY

Name

University/Laboratory Cooperative Program

Organizational location

Office of Energy Research
Division of University and Industry Programs

Legislative mandate

Derives legislative mandate from three basic energy education authorizations: (a) Atomic Energy Act of 1954, as amended, 42 U.S.C. 2051(a) and (b). The Atomic Energy Commission was authorized by the Act to

> insure the continued conduct of research and development and training activities . . ., by private or public institutions or persons, and to assist in the acquisition of an ever-expanding fund of theoretical and practical knowledge in such fields.

(b) Energy Reorganization Act of 1974, 42 U.S.C. 5813(10). The Act states that the Administrator of the Energy Research and Development Administration is responsible for

> helping to assure an adequate supply of manpower for the accomplishment of energy research and development programs, by sponsoring and assisting in education and training activities in institutions of higher education . . . .

(c) DOE Organization Act, 42 U.S.C. 7139. The Act states that the Director of the Office of Energy Research has the responsibility

> to advise the Secretary with respect to education and training activities required for effective short- and long-term basic and applied research activities of the Department.

Objective

To broaden the base of involvement in and subsequent contributions to the energy field by university faculty and students through the utilization of the diversified research facilities operated and maintained by DOE.

History

This was the first Federal energy-related training program. It grew out of research and training activities by college students and faculty at National Laboratories, which were sponsored by the former Atomic Energy Commission beginning in 1947. It was not until 1964, however, that these activities were formalized into one program, which has continued operation to the present time.

Description

The overall University/Laboratory Cooperative program encompasses a wide variety of activities that bring faculty and students to DOE National Labs, Energy Technology Centers, and other contractor-operated facilities. In 1980, a $3.2 million budget supported a total of 2,647 participants in program activities. There are 10 components to the overall program:

--faculty research participation: This activity is meant to develop the research and teaching capabilities of full-time faculty. Summer or academic year appointments are available with a general limitation of 12 months total participation. In 1980, 152 faculty appointments were made, at a total cost of $744,000.

--student research participation: The objective of this activity is to enhance available scientific educational opportunities and to attract promising students to energy research careers. Most appointments are for the summer period. In 1980, 658 upperclass undergraduate and 52 first-year graduate student appointments were made, at a cost of $1,082,000.

--laboratory graduate research participation: Selected full-time graduate students may receive appointments of up to 1 year, renewable to a maximum of 3 years, to carry out their Ph.D. or master's thesis research in residence at a DOE laboratory or Energy Research Center. The purpose is to provide an opportunity for graduate students to carry out their dissertation requirements when the necessary facilities or resources are not available on campus. In 1980, 125 graduate appointments were made, at a cost of $650,000.

--thesis parts research participation: This activity provides opportunities for full-time graduate students to conduct short-term portions of their research at a DOE facility that has a special resource or equipment required for the research. Participation ranges from a few days to several weeks. In 1980, 46 graduate student appointments were made, at a cost of $89,000.

--faculty research visits: Former research participants and other college and university faculty members who have special expertise of interest to laboratory professional staff may make arrangements for short research visits to continue collaborative research with laboratory staff. In 1980, 161 faculty members participated in this activity, at a cost of $89,000.

--faculty institutes: These are 1-to-4 week instructional sessions on various energy topics that are designed to aid faculty in teaching and in student guidance. This activity also includes in-service institutes that meet on a weekly basis during the academic year. In 1980, 137 faculty members participated in 8 institutes, at a cost of $85,000.

- --faculty workshops: These are usually 2-to-3 day sessions on special topics of interest to faculty members in which the laboratory may have on-going research programs. In 1980, 151 faculty members attended 11 workshops, at a cost of $90,000.

- --faculty-student experiments: Faculty members may conduct instructional sessions and experiments with their students on a time-and-space-available basis at two facilities with training laboratories (Argonne Center for Educational Affairs and Oak Ridge Associated Universities). In 1980, 298 faculty and students participated in such sessions, at a cost of $259,000.

- --conferences: Conferences on a broad range of topics associated with energy and its developing technology are presented in conjunction with universities or with professional organizations. In 1980, four conferences were held with a total attendance of 650 persons, at a cost of $65,000.

- --visiting staff lecturers: This activity allows professional staff from DOE facilities to visit campuses to lecture and participate in colloquia and conferences with faculty and students. In 1980, 217 staff members participated in such lecture visits, at a cost of $47,000.

Funding

fiscal year	(in thousands)
1978 (actual)	$3,380
1979 (actual)	3,200
1980 (actual)	3,200
1981 (estimate)	3,500
1982 (request)	3,600

Percentage engineering education

Program officials estimate that about 20 percent of the program is devoted to engineering education.

Name

University Reactor Fuel Assistance Program

Organizational location

Department of Energy
Office of Energy Research
Division of University and Industry Programs

Legislative mandate

Derives legislative mandate from three basic energy education authorizations: (a) Atomic Energy Act of 1954, as amended, 42 U.S.C. 2051(a) and (b). The Atomic Energy Commission was authorized by the Act to

> insure the continued conduct of research and development and training activities . . ., by private or public institutions or persons, and to assist in the acquisition of an ever-expanding fund of theoretical and practical knowledge in such fields.
>
> [Specific authorization is further provided] . . . to make grants and contributions to the cost of construction and operation of reactors and other facilities and other equipment to colleges, [and] universities, . . . for the conduct of educational and training activities . . . .

(b) Energy Reoganization Act of 1974, 42 U.S.C. 5813(10). The Act states that the Administrator of the Energy Research and Development Administration is responsible for

> helping to assure an adequate supply of manpower for the accomplishment of energy research and development programs, by sponsoring and assisting in education and training activities in institutions of higher education . . . .

(c) DOE Organization Act, 42 U.S.C. 7139. The Act states that the Director of the Office of Energy Research has the responsibility

> to advise the Secretary with respect to education and training activities required for effective short- and long-term basic and applied research activities of the Department.

Objective

To provide reactor fuel and financial support to specialized nuclear energy research and training facilities at selected universities.

History

This program was first established in 1967, under the former Atomic Energy Commission (AEC), as the Reactor Sharing and Fuel Assistance Program. The university research and training reactors had been established under varying financial sponsorship, including private, State, and Federal funds. AEC began to assist the universities in 1967 by providing funds for the procurement of the specialized reactor fuel and by supporting a portion of reactor operating costs when the reactors were shared with neighboring colleges and universities. The program has been continued by both the Energy Research and Development Administration and DOE, with no major changes.

Description

Currently 54 university research and training reactors are in operation in the United States. These are dual-purpose reactor facilities that are utilized for both research and educational purposes and that are not duplicated elsewhere, either in the National Laboratories or in private sector corporate laboratories. DOE provides funds as needed for the five components of the program:

--fuel fabrication and procurement: The program funds the cost of fuel fabrication and provides all fuel elements to the participating institutions as needed. The refueling requirements of the reactors vary from several times a year to once in several years. All fuel supplied belongs to the Federal Government; institutions use it under a lease agreement without charge for U-235 burn-up. In 1980, the program provided $1,428,000 for this purpose.

--reactor sharing: The program funds a portion of the operating costs of the reactor when the university shares its facility for research and training with other neighboring institutions. In 1980, $252,000 was provided for this purpose.

--spent fuel shipment: Depending on available funds, assistance may be provided to participating universities in covering the costs associated with shipping the spent fuel to a reprocessing site. Funding for this purpose was not available in 1980.

--heavy water losses and reprocessing: Heavy water is provided on a loan basis to some universities for certain types of experiments and for flux enhancement. The program reimburses the DOE production facility for any losses incurred in the use of heavy water and for the cost of reprocessing. In 1980, $20,000 was provided for this purpose.

--nuclear materials loans and grants: Neutron sources are made available on a loan or grant basis to the institutions. Uranium has also been provided on a loan basis for use in subcritical facilities. The institution must pay all shipping and handling charges. In fiscal year 1980, no funds were provided for this activity.

Program officials estimate that approximately 700 to 800 students plus 80 to 100 university researchers per year benefit from access to these reactors.

Funding

fiscal year	(in thousands)
1978 (actual)	$1,600
1979 (actual)	2,000
1980 (actual)	1,700
1981 (estimate)	1,400
1982 (request)	1,600

Percentage engineering education

Program officials estimate that about 50 percent of the program supports education in the field of nuclear engineering.

Name

Magnetic Fusion Energy Technology Fellowship Program

Organizational location

Department of Energy
Office of Energy Research
Office of Fusion Energy
Division of Development and Technology

Legislative mandate

No explicit authorization. Its legislative mandate is derived from three basic energy education authorizations: (a) Atomic Energy Act of 1954, as amended, 42 U.S.C. 2051(a) and (b). The Atomic Energy Commission was authorized by the Act to

> insure the continued conduct of research and development and training activities . . ., by private or public institutions or persons, and to assist in the acquisition of an ever-expanding fund of theoretical and practical knowledge in such fields.

(b) Energy Reorganization Act of 1974, 42 U.S.C. 5813(10). The Act states that the Administrator of the Energy Research and Development Administration is responsible for

> helping to assure an adequate supply of manpower for the accomplishment of energy research and development programs, by sponsoring and assisting in education and training activities in institutions of higher education . . . .

(c) DOE Organization Act, 42 U.S.C. 7139. The Act states that the Director of the Office of Energy Research has the responsibility

> to advise the Secretary with respect to education and training activities required for effective short- and

long-term basic and applied research activities of the Department.

Another, but still less than explicit, mandate can be found in the Magnetic Fusion Energy Engineering Act of 1980, 42 U.S.C. 9301 et seq. The legislation states that the

> Secretary shall assess the adequacy of the projected United States supply of manpower in the engineering and scientific disciplines required to achieve the purposes of this Act . . . [and] submit a report . . . setting forth his assessment along with his recommendations regarding the need for increased support for education in such engineering and scientific disciplines.

Objective

To train a small number of highly qualified graduate engineering students for careers in the magnetic fusion engineering field.

History

This program was initiated by DOE in 1980.

Description

In 1981, the first year of implementation of the program, six fellowships were awarded to Ph.D. candidates. Students apply directly to Oak Ridge Associated Universities, which manages the program for DOE. Participants must be enrolled at one of the eleven universities that have met program criteria and have been designated as participating institutions. Fellows receive a stipend of $1,000 per month or $12,00 per year, plus up to $6,000 in tuition costs. Awards are made directly to the student for a 1-year period with renewal possible for up to 4 years. Plans call for addition of 6 fellows a year until a goal of 24 participants annually is reached.

Funding

fiscal year	(in thousands)
1978 (actual)	$ --
1979 (actual)	--
1980 (estimate)	20
1981 (estimate)	200
1982 (request)	420

The funding for 1980 reflects the program's start-up costs.

Percentage engineering education

Program officials estimate that 100 percent of fellows will study in the field of fusion engineering.

Name

Solar Energy Meteorological Research and Training Site Program

Organizational location

Department of Energy
Assistant Secretary for Conservation and Renewable Energy
Deputy Assistant Secretary for Renewable Energy
Office of Solar Electric Technologies
Division of Photovoltaic Energy Technology

Legislative mandate

No explicit authorization. Its legislative mandate is derived from three basic energy education authorizations: (a) Atomic Energy Act of 1954, as amended, 42 U.S.C. 2051(a) and (b). The Atomic Energy Commission was authorized by the Act to

> insure the continued conduct of research and development and training activities . . ., by private or public institutions or persons, and to assist in the acquisition of an ever-expanding fund of theoretical and practical knowledge in such fields.

(b) Energy Reorganization Act of 1974, 42 U.S.C. 5813(10). The Act states that the Administrator of the Energy Research and Development Administration is responsible for

> helping to assure an adequate supply of manpower for the accomplishment of energy research and development programs, by sponsoring and assisting in education and training activities in institutions of higher education . . . .

(c) DOE Organization Act, 42 U.S.C. 7139. The Act states that the Director of the Office of Energy Research has the responsibility

> to advise the Secretary with respect to education and training activities required for effective short- and long-term basic and applied research activities of the Department . . . .

Objective

To upgrade the quality, availability, and standardization of solar-related meteorological data and to stimulate the development of quality educational and training opportunities that are oriented toward meeting local, regional, and national needs.

History

The program was established in June 1977 by DOE's predecessor, the Energy Research and Development Administration, with the selection of eight universities at which solar energy training centers were set up. DOE was established in August 1977 and continued the program. In the first year of the program's operation (1977), a funding level of $200,000 per university per year, or $1.6 million total, was established. A 5-year commitment of Federal support to the program was made, assuring each participating university receipt of $1 million over 5 years in order to run the program.

Description

The program is technically monitored by the Solar Energy Research Institute in Golden, Colorado. Each of the eight participating universities has developed its own program to collect detailed insolation and meteorological data needed for advanced solar energy studies and to act as a regional training center for meteorologists and solar engineers. Solar radiation and energy course work is offered at both the undergraduate and graduate level, with emphasis at the masters level. Direct student support is provided to graduate students who work as research assistants. There is an estimated average of three to four research assistants at each university, who receive about $5,000 a year in salaries. Program officials estimate that an average of 12 percent of program funds are devoted to education and training activities, with an additional 6 percent for curriculum development and 5 percent for instructional equipment.

Funding

fiscal year	(in thousands)
1978 (actual)	$1,600
1979 (actual)	1,600
1980 (actual)	1,000
1981 (estimate)	1,080
1982 (request)	1,120

There has never been a specific budget request for this program. It has been funded through the office of the Deputy Assistant Secretary for Solar Energy, which assesses the solar programs and allocates funds within the Division. The variability in funding levels starting in 1980 is due to DOE budget constraints that resulted in smaller than anticipated payments to all centers.

Percentage engineering education

Program officials estimate that at least 20 percent of the program is devoted to engineering education in the field of solar energy systems engineering.

Name

DOE-ASEE Summer Faculty Program in Solar Thermal Research and Development

Organizational location

Department of Energy
Assistant Secretary for Conservation and Renewable Energy
Deputy Assistant Secretary for Renewable Energy
Office of Solar Heat Technologies
Division of Solar Thermal Technology

Legislative mandate

No specific authorization. Its legislative mandate is derived from three basic energy education authorizations: (a) Atomic Energy Act of 1954, as amended, 42 U.S.C. 2051(a) and (b). The Atomic Energy Commission was authorized by the Act to

> insure the continued conduct of research and development and training activities . . ., by private or public institutions or persons, and to assist in the acquisition of an ever-expanding fund of theoretical and practical knowledge in such fields.

(b) Energy Reorganization Act of 1974, 42 U.S.C. 5813(10). The Act states that the Administrator of the Energy Research and Development Administration is responsible for

> helping to assure an adequate supply of manpower for the accomplishment of energy research and development programs, by sponsoring and assisting in education and training activities in institutions of higher education . . . .

(c) DOE Organization Act, 42 U.S.C. 7139. The Act states that the Director of the Office of Energy Research has the responsibility

> to advise the Secretary with respect to education and training activities required for effective short- and long-term basic and applied research activities of the Department . . . .

Objective

To further the professional development of science and engineering faculty in solar thermal research and, at the same time, to further DOE's areas of interest in solar thermal research and development.

History

The program was first initiated by DOE in 1980. Twenty-three science and engineering faculty members spent 10 weeks from June to August at four participating DOE Solar Thermal R&D centers. In summer 1981, the program supported 25 faculty members.

Description

Faculty members are selected competitively to conduct research at DOE solar thermal R&D facilities and to work with professional peers on research and development tasks of mutual interest. Research tasks are defined in advance through correspondance and a preprogram visit to the DOE installation where the participant will spend the summer. The Summer Faculty Program Committee of the American Society for Engineering Education (ASEE) supervises the program to ensure that it furthers the professional development of faculty participants, as well as fulfilling DOE research and development interests. The primary criterion for selection of participants is the match between the applicant's research interests and experience and the research tasks of the host laboratories. Each faculty member receives a stipend of $450 per week for 10 weeks plus travel expenditures.

Funding

fiscal year	(in thousands)
1978 (actual)	$ --
1979 (actual)	--
1980 (actual)	168
1981 (actual)	172
1982 (request)	200

Percentage engineering education

In 1980, 12 of the 23 faculty participants (52.2 percent) were in engineering fields.

DEPARTMENT OF HEALTH AND HUMAN SERVICES

Name

National Research Service Awards
(Predoctoral Institutional Training Grants)

Organizational location

Public Health Service
National Institutes of Health (NIH)

Legislative mandate

National Research Service Award Act of 1974, as amended, 42 U.S.C. 289l-1 (note). The Act establishes that "direct support of the training of scientists for careers in biomedical and behavioral research is an appropriate and necessary role for the Federal Government. . . ." Among the means of support specified in the Act is provision for

> grants to non-Federal public institutions and nonprofit private institutions to enable such institutions to make to individuals selected by them National Research Service Awards for research [and training to undertake such research]. . . .

Objective

To provide for the research training of biomedical and behavioral scientists.

History

Prior to 1974, graduate training and fellowship grants were provided under provisions in the Ransdell Act of 1930, the Public Health Service Act of 1944, and various acts authorizing the institutes that make up NIH. The 1974 budget request proposed phasing out NIH fellowship and training grant programs. The Congress opposed this proposal and consolidated NIH training programs under the National Research Service Award Act of 1974.

Description

The National Research Service Award program encompasses individual fellowships and institutional training grants on both the predoctoral and postdoctoral levels. However, since postdoctoral support lies outside of our scope and none of the individual predoctoral fellows studied engineering in 1980, this description will be limited to the predoctoral institutional training grants only.

In this program, each participating institution selects trainees and is responsible for program operations. Trainees receive an annual stipend of $5,040 and are eligible for up to 5 years of support.

Trainees agree to "pay back" the support they receive through the performance of biomedical research and/or teaching for a period of time equal to the number of semesters for which they have received support beyond the first 12 months. 1/ Failure to comply with this service requirement entitles the Government to recover the amount of the stipend plus interest.

Institutional grants also provide trainees tuition, fees, and travel costs. In addition, institutions may receive an allowance to cover the salaries of faculty members and staff and up to 8 percent of allowable direct costs (all costs except tuition, fees, and equipment) to cover indirect costs.

1/Elimination of payback obligation for the first 12 months of training effected by Omnibus Reconciliation Act of 1981, Public Law 97-35.

Funding

fiscal year	(in thousands)
1978 (actual)	$51,081
1979 (actual)	49,124
1980 (actual)	53,737
1981 (estimate)	64,390
1982 (request)	43,284

These figures represent amounts budgeted for NIH predoctoral trainee support and institutional allowances. Most of the 1982 funding reduction is a result of the elimination of institutional allowances and indirect costs from institutional grants.

Percentage of engineering education

According to data supplied by NIH, 139 individuals received full- or part-time support (full-time support for less than 9 months in a fiscal year) for training in bio-engineering in 1979. This is 2.5 percent of individuals who received predoctoral support.

DEPARTMENT OF THE INTERIOR

Name

State Mining and Mineral Resources
and Research Institutes (MMRRIs) Program

Organizational location

Office of Surface Mining Reclamation and Enforcement
Technical Standards and Research
Division of Technical Assistance

Legislative mandate

The Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. 1201 *et seq*.

The Act established State Mining and Mineral Resources and Research Institutes to enhance research and educational mining and mineral sciences programs within the States: "It shall be the duty of each such institute . . . to provide for the training of mineral engineers and scientists through . . . research, investigations, demonstrations, and experiments."

Objective

To enhance training opportunities for individuals as mining and mineral engineers and scientists; and to conduct competent research, investigations, demonstrations, and experiments of a basic or practical nature involving mining and mineral resources.

Research problems are related to the mission of DOI and have industry-wide application.

History

The MMRRI program was initiated in 1978, with funding provided to 20 of the 37 colleges and universities found qualified under program standards set up in the Act. The appropriations committees of the Congress have added eleven more: two in 1979 and nine in 1980. There are presently 31 qualified institutes at designated colleges and universities. No State has more than one institute.

Description

Federal assistance to the MMRRI program has three components:

--program administration or annual allotment grants: Each of the 31 institutes receives an annual allotment grant of $110,000. This allotment is matched by at least an equal amount of non-Federal funds. The institutes use the allotment funds for improvement of scientific facilities, including equipment for curriculum expansion and employment of additional faculty, administrative and management costs of the institute, and to fund pilot research projects with potential industry-wide and specific industrial applications. Program officials estimate that, in general, the institutes allocate about 32 percent ($35,000) of the allotment grant for total administrative and management costs, 32 percent ($35,000) for instructional equipment, and 36 percent ($40,000) for pilot research projects. In 1980, a total of $2.8 million was provided for allotment funds.

--scholarship, fellowship, and post-doctoral fellowship grants: A block grant of approximately $54,000 per year is awarded to each of the 31 institutes for scholarships, graduate fellowships, and post-doctoral fellowships. Each institute distributes the funds among its students on the basis of merit to encourage them to continue in their chosen mineral resources field. In 1980, 322 students were supported: 168 undergraduate, 107 masters, 43 doctoral, and 4 post-doctoral students. Budget authority in 1980 was $1,440,000.

--research grants: Federal funds for the research grants are awarded to the institutes on a competitive, individual project merit basis. In 1980, 91 research projects were funded at a total cost of $5.3 million.

Funding

fiscal year	(in thousands)
1978 (actual)	$ 5,700
1979 (actual)	5,800
1980 (actual)	10,000
1981 (estimate)	9,629
1982 (request)	0

The variability in funding levels is the result, first, of the program's growth in terms of number of institutes funded, and, second, of a change in the scholarship/fellowship grant cycle. Twenty institutes were funded in 1978; two additional institutes were funded in 1979; and nine more were added in 1980 for a total of 31 Mineral Institutes. At the same time, the scholarship/fellowship grant cycle was changed in 1981 from a 3-year, $160,000 block grant to each institute to a 1-year grant cycle designed to provide approximately $54,000 annually to each school.

Percentage engineering education

About 72 percent is devoted to engineering education of scientists and engineers, with study in the fields of mining (including exploration and minerals processing), metallurgical, ceramics, petroleum, geological, and environmental engineering.

DEPARTMENT OF TRANSPORTATION

Name

Aid to State Maritime Academies

Organizational location

Maritime Administration
Maritime Labor and Training Office

Legislative mandate

Maritime Education and Training Act of 1980, 46 U.S.C. 1295 et seq. (previous authority: the Maritime Academy Act of 1958 (Public Law 85-672, 46 U.S.C. 1381-1388) repealed by 1980 Act); Maritime Act of 1981, Public Law 97-31, 95 Stat. 151.

The 1980 Act states "The Secretary [of Commerce] shall cooperate with and assist any State maritime academy in providing instruction to individuals to prepare them for service in the merchant marine of the United States."

Objective

To provide for the education and training of citizens of the United States who are capable of providing for the safe and efficient operation of the merchant marine of the United States at all times and as a naval and military auxiliary in time of war or national emergency.

History

Federal assistance to State maritime academies can be traced back to 1874 when legislation was passed authorizing the loan of naval vessels and Navy officers as faculty to State schools. In 1940, Federal rating and certification of such schools and inspection of their training vessels was mandated. Comprehensive Federal policy with regard to these institutions was established by the Maritime Academy Act of 1958. The Maritime Education and Training Act of 1980 recodified Federal policy toward the State academies. It was passed after nearly 4 years of investigation and debate on the appropriate Federal role in maritime education. The Maritime Act of 1981 transferred the Maritime Administration to the Department of Transportation.

Description

The Department provides the academies with three forms of assistance:

--A $100,000 annual assistance payment to each school for general maintenance and support. This amount is reduced to $25,000 if the academy does not admit a certain number of out-of-State students each year. Portions of the annual assistance payment may go toward instructional equipment and faculty or curriculum development; however, statistics providing such a breakdown are not available.

--Provision, maintenance, and repair of training vessels for five of the schools. The Michigan academy, a 3-year school with an associates degree program, is not provided with a training vessel.

--A limited number of incentive payments of $1,200 per student per year. These payments are provided directly to students; they are distributed among the academies in a "fair and equitable manner" and carry a service obligation of 6 years in the military reserves and 3 years of maritime industry service. Approximately two-thirds of the students in attendance receive such support.

The academies generally offer a 4-year curriculum leading to either a marine engineering or nautical science degree. Graduates must pass the appropriate Coast Guard examination to be licensed as deck or engineering officers. Total enrollment is approximately 3,000.

Funding

fiscal year	(in thousands)
1978 (actual)	$ 3,741
1979 (actual)	5,220
1980 (actual)	11,459
1981 (estimate)	7,530
1982 (request)	10,180

Most of the variation in funding levels can be attributed to varying annual need for repair or replacement of training vessels.

Percentage engineering education

Approximately 50 percent of students study marine engineering, according to program officials.

Name

United States Merchant Marine Academy

Organizational location

Department of Transportation
Maritime Administration

Legislative mandate

Merchant Marine Act, 1936, 46 U.S.C. 1101 et seq., as amended by the Maritime Education and Training Act of 1980, 46 U.S.C. 1295 et seq.; the Maritime Act of 1981, Public Law 97-31, 95 Stat. 151.

The 1980 Act states "The Secretary [of Commerce] shall maintain the Academy for providing instruction to individuals to prepare them for service in the merchant marine of the United States."

Objective

To provide for the education and training of citizens of the United States who are capable of providing for the safe and efficient operation of the merchant marine of the United States at all times and as a naval and military auxiliary in time of war or national emergency.

History

The Academy was established in 1938 following passage of the Merchant Marine Act, 1936. The campus at Kings Point, New York, was dedicated in 1943. A 4-year college level program of study was instituted following the emergency operations forced by World

War II. In 1946, the Congress authorized the granting of the bachelor of science degree, and the school began awarding such degrees upon accreditation by the Middle States Association of Colleges and Schools in 1949. The Academy was made a permanent institution in 1956 and was placed under the authority of the Department of Commerce. Women were first admitted in 1974. The Maritime Education and Training Act of 1980 recodified Federal policy toward the academy. It was passed after nearly 4 years of investigation and debate on the appropriate Federal role in maritime education. The Maritime Act of 1981 transferred the Maritime Administration to the Department of Transportation.

Description

The Academy is almost completely funded by the Federal Government. Students do not pay any tuition and are provided with free room and board and initial issuance of uniforms and textbooks. Students must pay only $200-$300 per year for supplies and activity fees. About $230,000 is expended annually for routine replacement of instructional equipment and furnishings. Faculty and curriculum development activities take place, but statistics on expenditure in these areas are not maintained.

Students earn B.S. degrees in nautical science or in marine engineering, spending one-half of their sophomore and junior years on merchant vessels. Graduates must pass the appropriate Coast Guard examination to be licensed as deck or engineering officers. Graduation carries with it an obligation for 6 years of service in a military reserve unit and 5 years of service in the maritime industry. Enrollment is approximately 1,100.

Funding

fiscal year	(in thousands)
1978 (actual)	$13,334
1979 (actual)	15,056
1980 (actual)	17,431
1981 (estimate)	18,519
1982 (request)	19,205

The Academy is currently engaged in a decade long $30 million modernization program. Expenditure for this purpose makes up $3-$4 million per year of the academy's budget.

Percentage engineering education

Approximately 50 percent of students study marine engineering, according to program officials.

Name

U.S. Coast Guard Academy

Organizational location

Department of Transportation
U.S. Coast Guard

Legislative mandate

Act of August 4, 1949 (c. 393); 14 U.S.C. 181 et seq. This legislation was enacted to place the Coast Guard Academy and its operation on a statutory basis. Previously, there had been no provision in existing law that established the Academy and set it up as an operating unit. It had been operating solely on the basis of regulations.

Objective

To educate and train young men and women for service as commissioned officers in the U.S. Coast Guard.

History

The U.S. Coast Guard Academy traces its origins back to the Revenue Cutter School of Instruction, established in 1876. In 1915, the Revenue Cutter Service was merged with the Life Saving Service to form the U.S. Coast Guard, and the Academy received its present name. Funds were appropriated in 1931 to build the Academy in New London, Connecticut, its present site. Since that time, the Academy has grown steadily, expanding to accommodate the increased size of the corps. Women have been accepted since 1976.

Description

The Academy provides a fully accredited 4-year undergraduate education leading to a bachelor of science degree. Students receive room, board, and tuition. In addition, each cadet receives an allowance of approximately $4,500 a year. Selection of cadets is determined on the basis of merit in an annual nationwide competition. The class of 1983 admitted 270 men and 34 women; total enrollment at the academy in 1980 was 905. Upon graduation, cadets receive a commission as an Ensign in the U.S. Coast Guard and have a 5-year service obligation.

Funding

fiscal year	(total academy funding in thousands)
1978 (actual)	$23,000
1979 (actual)	24,000
1980 (actual)	28,600
1981 (estimate)	31,000
1982 (request)	33,500

Percentage engineering education

In 1980, 30.6 percent of the cadets were engineering majors, in the fields of civil, electrical, marine, and ocean engineering.

Name

Center of Excellence in Motor Vehicle Safety Research (COE)

Organizational location

Department of Transportation
National Highway Traffic Safety Administration (NHTSA)
Vehicle Research and Test Center (VRTC)
Safety Research Laboratory

Legislative mandate

The Highway Safety Act of 1966, 23 U.S.C. 403. The Act authorizes the Secretary of Transportation to fund "grants to . . . State or local agencies, institutions, and individuals for (1) training or education of highway safety personnel, [and] . . . research fellowships in highway safety . . . ."

Objective

To conduct research, development, and testing on motor vehicle safety problems and to train graduate and undergraduate students for research in motor vehicle safety through work/study programs.

History

The Center of Excellence was initiated by the Department to provide focused academic training in motor vehicle safety research. It was established in the fall of 1978 as a joint endeavor of Ohio State University and the Vehicle Research Test Center of the National Highway Traffic Safety Administration (NHTSA). Actual funding and implementation did not start, however, until late 1979.

Description

Center of Excellence research projects are designed to be subelements of larger projects being conducted at the Safety Research Laboratory of the Vehicle Research and Test Center of NHTSA. Each Center of Excellence project is the result of a contract negotiated between NHTSA and Ohio State University. The projects are designed to serve a dual purpose of accomplishing research and providing training for students. Students are chosen on the basis of the match between the lab's research needs and the students' area of focus. Students participate as research assistants and, as a result, receive specialized training and experience in the application of engineering principles to problems of motor vehicle safety. Approximately 37 students and 16 faculty members are involved in

Center of Excellence projects. Projects often contain the research basis for a graduate thesis: in April 1981, there were 11 masters- and five doctorate-level thesis projects in progress. Program officials estimate that about 50 percent of the funds are used for student support, 10 percent for faculty support, and 40 percent for miscellaneous expenses such as computer time, travel expenses, and supplies and equipment needed for the project.

Funding

fiscal year	(in thousands)
1978 (actual)	$ --
1979 (actual)	--
1980 (actual)	312
1981 (estimate)	550
1982 (request)	N/A

There is no budget request for the Center of Excellence program. Funding is derived entirely from existing budget allocations of the agency, primarily from research funding. The 1981 funding figure represents estimates by program officials. Funding for 1982 is not available since information on 1982 project activity is not yet known.

Percentage engineering education

According to program officials, 95 percent of the program is devoted to engineering education. The majority of Center of Excellence students are in mechanical or electrical engineering, with other students in civil and agricultural engineering.

Name

FHWA Fellowship and Scholarship Program

Organizational location

Department of Transportation
Federal Highway Administration (FHWA)
National Highway Institute (NHI)
University and Industry Programs Office

Legislative mandate

The Federal Aid Highway Act of 1970, 23 U.S.C. 307(a), 315, 321, 403. The Act authorizes the Secretary to establish and operate a National Highway Institute which shall

> develop and administer, in cooperation with the State highway departments, training programs of instruction for Federal Highway Administration and State and local highway department employees engaged or to be engaged in Federal-aid highway work.

Objective

To assist State and local transportation agencies and the FHWA in developing the staff expertise needed for implementation of highway programs.

History

Fellowship and scholarship grants were first awarded by NHI in 1972. In the first year, 12 grants were made for full-time study for 12 months. In 1976, the program was expanded to include part-time study for 24 months as well. During the 1972 through 1980 academic years, a total of 982 grants were made.

Description

Applicants to the FHWA Fellowship and Scholarship Program must be employed by the FHWA or by State or local highway transportation departments. Recipients usually have at least 3 years work experience with their employing agency. Selection is based on agency endorsement and a rating by a selection panel appointed by the Director of NHI. Grant recipients agree to work for their agency for a period three times the length of their training for full-time study or half the length of their training for part-time study, or they must repay the grant.

The overall program activity has two components:

--the Scholarship Program in Highway Technology: Grants are made to support undergraduate education, with awards up to $5,000 for full-time study and up to $3,000 for part-time study. In 1980, 58 scholarships were funded at a cost of $140,000.

--the Fellowship Program in Highway Safety and Transportation: These grants support graduate education, with awards up to $7,500 for full-time and up to $4,000 for part-time study. In 1980, 94 fellowships were funded at a cost of $279,000.

Funding

fiscal year	(in thousands)
1978 (actual)	$571
1979 (actual)	464
1980 (actual)	459
1981 (estimate)	326
1982 (request)	326

Percentage engineering education

Program officials estimate that an average of 51.7 percent of scholarship grants and 60.6 percent of fellowship grants were devoted to engineering education in 1980, in the fields of transportation, civil, mechanical, electrical, and sanitary engineering. For the overall program, 52.6 percent of total funding was for engineering education.

Name

University-FHWA College Curriculum Program

Organizational location

Department of Transportation
Federal Highway Administration (FHWA)
National Highway Institute (NHI)
University and Industry Programs Office

Legislative mandate

The Federal-Aid Highway Act of 1970, 23 U.S.C. 307(a), 315, 321, 403. The Act authorizes the Secretary to establish and operate a National Highway Institute which shall

> develop and administer, in cooperation with the State highway departments, training programs of instruction for Federal Highway Administration and State and local highway department employees engaged or to be engaged in Federal-aid highway work.

Objective

To provide academic institutions with state-of-the-art highway technology training and educational resources.

History

The University-FHWA College Curriculum program was established in 1975 to facilitate the transfer of curriculum materials to academic institutions. The program has grown steadily and, in 1980, 508 curriculum packages were provided to approximately 120 schools.

Description

The College Curriculum Program is designed to share the FHWA's most up-to-date technology with academia. College faculty play an important role in developing and conducting training programs for transportation agency employees and future employees through regular undergraduate and graduate courses, as well as through special short course offerings. Therefore, curriculum materials that the FHWA has developed for its program for Federal, State, and local highway employees are made available to colleges and universities without charge. The only cost to the NHI is the nominal cost of duplicating the curriculum materials for distribution, estimated to be about $58 per package.

Funding

fiscal year	(in thousands)
1978 (actual)	$ 8
1979 (actual)	13
1980 (actual)	29
1981 (estimate)	29
1982 (request)	N/A

Percentage engineering education

Program officials estimate that at least 70 percent of the curriculum materials are in the field of engineering education.

ENVIRONMENTAL PROTECTION AGENCY

Name

Air Pollution Traineeship Program

Organizational location

Office of Air, Noise, and Radiation
Office of Air Quality Planning and Standards
Control Programs Development Division
Manpower and Technical Information Branch

Legislative mandate

The Clean Air Act, as amended, 42 U.S.C. 1857 *et seq*., was the original legislative authorization. It was revised and reclassified by the Clear Air Act Amendments of 1977, 42 U.S.C. 7401 *et seq*.

The specific mandate for training is found under section 7403(a)(5) and (b): to "conduct and promote coordination and acceleration of training for individuals relating to the causes, effects, extent, prevention, and control of air pollution." For this purpose, the administrator is specifically authorized to

> provide training for, and make training grants to, personnel of air pollution control agencies and other persons with suitable qualifications and make grants to such agencies, to other public or non-profit private agencies, institutions, and organizations . . . .

Objective

To assist State and local air pollution control agencies in acquiring and maintaining the technical and professional level skills needed for effective conduct of air pollution abatement programs.

History

Air pollution traineeships were first started in 1964 as a part of the academic training programs of the U.S. Public Health Service of the former Department of Health, Education, and Welfare. In 1970, environmental training programs were transferred to the newly created EPA. In 1972, the agency received a directive from OMB requiring EPA to phase out its training effort by 1976. EPA complied and has not requested academic training funds since that time. The agency has, however, conducted activities of this type each year due to congressional add-on funding.

Description

Graduate study grants are awarded to eight universities that have been designated as EPA Area Training Centers. Each academic institution selects trainees from eligible full-time State and local air pollution control employees with at least a year of work experience with their agency. Other qualified persons may also receive support. Awards are made to graduate students in masters degree programs, usually to fund their last year of study. The training grant includes tuition, fees, books, and a stipend. State and local agency employees receive a $7,500 per year stipend, and non-employees receive a $4,080 per year stipend. The grant is made on a "forgiveable loan" basis: If the recipient works 2 years for a State or local air pollution control agency for each year of support received, they do not have to repay the loan. In 1980, 36 air pollution traineeships were awarded.

Funding

fiscal year	(in thousands)
1978 (actual)	$350
1979 (actual)	246
1980 (estimate)	380
1981 (estimate)	235
1982 (request)	0

Percentage engineering education

Program officials estimate that approximately 50 percent of the program is devoted to engineering education, in the field of environmental engineering.

Name

Academic Grants in Solid Waste Technology

Organizational location

Environmental Protection Agency
Office of Solid Waste and Emergency Response
Office of Solid Waste

Legislative mandate

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6981(a). The Administrator of EPA is authorized by the Act to

> conduct, and encourage, cooperate with, and render financial and other assistance to appropriate public . . . authorities, agencies, and institutions, private agencies and institutions, and individuals in the conduct of, and promote the coordination of, research, investigations, experiments, training . . . [relating to solid waste problems].

Objective

To support the development of curriculum materials in hazardous waste management.

History

The program was initiated by EPA in 1979 when four grants were awarded to academic institutions to develop curriculum materials in the hazardous waste field. The number of projects funded by the program has declined, with three awards in 1980 and two in 1981. There has been no budget request for the program since all EPA academic training efforts were directed by OMB to be phased-out in 1976. Academic training programs have been funded since that time due to congressional add-on funding.

Description

The Office of Solid Waste competitively awards one-time grants to academic institutions for development of curricula and instructional materials in hazardous waste management. These materials are intended for use by both academia and professional scientists and engineers working in the solid waste technology field. In 1980, three curriculum development projects were funded, with grants ranging from $30,000 to $60,000.

Funding

fiscal year	(in thousands)
1978 (actual	$ --
1979 (actual)	109
1980 (actual)	120
1981 (actual)	64
1982 (request)	0

Percentage engineering education

Program officials estimate that in 1980 approximately 50 percent of the program was devoted to engineering education, in the fields of civil, environmental, and sanitary engineering.

Name

Academic Training Program in Water Pollution Control

Organizational location

Environmental Protection Agency
Office of Water Program Operations
National Training and Operational Technology Center

Legislative mandate

Water Pollution Control Act, June 30, 1948, 62 Stat. 1155; Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500, as amended by the Clean Water Act of 1977, Public Law 95-217, 33 U.S.C. 1254(a), (b), and (g). The Act states that

> for the purpose of providing an adequate supply of personnel to operate and maintain existing and future treatment works and related activities, and for the purpose of enhancing substantially the proficiency of those engaged in such activities, the Administrator shall finance pilot programs, . . . of manpower development and training and retraining of persons in, or entering into, the field of operation and maintenance of treatment works and related activities.

The Act authorizes the Administration to

> make grants to public or private agencies and institutions and [to] individuals for training projects, . . . to establish and maintain research fellowships in the Environmental Protection Agency . . ., [and to] provide . . . training in technical matters relating to the causes, prevention, reduction, and elimination of pollution for personnel of public agencies and other persons with suitable qualifications.

Objective

To support the training of professional's in water-related engineering and environmental sciences.

History

Academic training programs in water quality and water pollution control were administered by the Department of the Interior until their transfer to EPA in 1970. At its peak in 1973, EPA's graduate training program budget was almost $6 million, with 109 participating institutions and 1,136 participating students. In 1972, OMB directed the phase-out of all academic training by June 1976. In 1976, only about 29 schools were still participating. Since 1976, the agency has not requested academic training funds, but training has been funded by congressional add-on. Since 1976, EPA has focused available training resources more on State water pollution control agency employees, rather than on general student support in relevant fields.

Description

EPA's academic training program varies each year according to the level of funding received by congressional add-on. There are three general components to the program:

- --professional training grants: Grants are made by participating institutions to students in the form of traineeships. The preponderance of support is for graduate study. The program was cut back due to a change in focus in EPA's academic training to support of State agency employees rather than general student support. In 1980, $105,000 was awarded to 26 universities to support 32 students in graduate-level engineering programs related to water pollution control. The program received no funding in 1981.

- --state agency fellows: This program is designed to assist State water pollution control agencies in upgrading the professional capabilities of their personnel. EPA provides funds to State agencies to award fellowships to selected full-time employees on a "forgiveable loan" basis. Recipients attend relevant courses usually on a part-time basis. They are not obligated to repay the loan if they work 2 years for the agency for each year of academic support received. The average cost per student is $3,429. In 1980, 72 trainees were supported in 29 States at a cost of $158,000.

- --curriculum development in water pollution control: EPA provides "seed money" to establish curriculum development projects at colleges or universities at the undergraduate or graduate level. The grants are used to develop curricula, initiate programs, provide limited student support in the early stages of the program, and disseminate information to other education and training organizations. The project agreement includes a definite time limit for phase-out of EPA support (usually three years), after which the university continues the program on its own. In 1980, three curriculum development projects were funded at a cost of $175,000.

Funding

fiscal year	(in thousands)
1978 (actual)	$940
1979 (actual)	415
1980 (actual)	438
1981 (estimate)	0
1982 (request)	0

Percentage engineering education

Program officials estimate that 75 percent of the academic training program goes to environmental engineering education.

Comments

Fiscal year 1981 authorization of $270,000 in funding for this program was rescinded late in the fiscal year. According to program officials, funding was restored at the last moment, but it was too late for them to obligate funds for the 1981 fiscal year. On October 1, 1981, the National Training and Operational Technology Center in Cincinnati, Ohio, went out of existence, and grant close-out authority was returned to EPA headquarters in Washington, D.C.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Name

Computational Fluid Dynamics (CFD) Training Program

Organizational location

Office of Aeronautics and Space Technology
Research and Technology Division
Aerodynamics Office

Legislative mandate

National Aeronautics and Space Act of 1958, 42 U.S.C. 2473. The Act, as interpreted by NASA, serves as broad enabling legislation for training and research agreements with universities. The Act provides for

> participation by the scientific community in planning scientific measurements and observations . . . [and for] the widest practicable and appropriate dissemination of information.
>
> [The Act allows the agency] to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary . . . with any . . . educational institution.

Objective

To provide NASA and the aerospace industry with personnel trained in computational fluid dynamics by establishing interdisciplinary curricula at participating universities.

History

The program was initiated in 1980 at seven universities that were competitively chosen from the sixteen universities in the

Nation that conduct computational fluid dynamics research. Eighteen students at the M.S. or Ph.D. level participated at five universities during the first year of operation. In 1981 enrollment increased to 25 students at the seven universities selected.

Description

Each participating university selects masters and doctoral level students for an advanced degree program in computational fluid dynamics. Awards are made on an annual basis and are renewable. Students receive a stipend of $6,000 during the academic year, and universities are required to provide free tuition to program participants. Students are offered the opportunity to work during the summer months at a NASA research center, with salary and limited travel expenses provided from program funds. Program grants to the universities cover up to 20 percent of faculty salaries and also provide funds for hiring adjunct professors. This program is designed to become self-sufficient after 4 years of operation, at which time program funding would then be assumed by the participating universities.

Funding

fiscal year	(in thousands)
1978 (actual)	$ 0
1979 (actual)	0
1980 (actual)	375
1981 (estimate)	650
1982 (request)	700

Percentage engineering education

Computational Fluid Dynamics is an interdisciplinary program of study open to students from several disciplines. In 1980, 72 percent of the program participants were enrolled in aeronautical engineering programs.

Name

Graduate Research Program in Aeronautics

Organizational location

National Aeronautics and Space Administration
Office of Aeronautics and Space Technology
Research and Technology Division

Legislative mandate

National Aeronautics and Space Act of 1958, 42 U.S.C. 2473. The Act, as interpreted by NASA, serves as broad enabling legislation for training and research agreements with universities. The Act provides for

> participation by the scientific community in planning scientific measurements and observations . . . [and for] the widest practicable and appropriate dissemination of information.
>
> [The Act allows the agency] to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary . . . with any . . . educational institution.

Objective

To supply aeronautical research engineers for NASA and the aerospace industry.

History

This program was initiated in 1971 in response to congressional concerns over the declining number of students entering aeronautical engineering and NASA's problems in finding engineers to replace its aging population of aeronautical researchers. During the first year of operation, $1.1 million was awarded to 30 faculty members and 44 students.

Description

NASA research centers accept unsolicited research proposals and award cooperative research grants to university faculty. Grantees then select student research assistants to conduct supervised thesis or dissertation research at the Ames, Langley, or Lewis research centers. The amount and duration of support to individual students varies according to the terms of each grant. Typically, students spend 3 to 6 months at the research facility and the rest of their time at the university. Two-thirds of the students are at the masters level and one-third are at the Ph.D. level. Sixty-eight students were enrolled in the program in 1980, with 49 faculty.

Funding

fiscal year	(in thousands)
1978 (actual)	$1,150
1979 (actual)	1,100
1980 (actual)	800
1981 (estimate)	900
1982 (request)	1,100

Percentage engineering education

All students enrolled in the program are aeronautical engineering majors, according to program officials.

Name

Post-Baccalaureate Program in Aeronautics

Organizational location

National Aeronautics and Space Administration
Office of Aeronautics and Space Technology
Research and Technology Division

Legislative mandate

National Aeronautics and Space Act of 1958, 42 U.S.C. 2473. The Act, as interpreted by NASA, serves as broad enabling legislation for training and research agreements with universities. The Act provides for

> participation by the scientific community in planning scientific measurements and observations . . . [and for] the widest practicable and appropriate dissemination of information.
>
> [The Act allows the agency] to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary . . . with any . . . educational institution.

Objective

To supply newly graduated aeronautical research engineers for NASA and the aerospace industry.

History

This program was initiated in 1980.

Description

NASA research centers accept unsolicited research proposals and award cooperative research grants to university faculty. In turn, grantees hire undergraduate and masters-level engineering students as research assistants. The amount and duration of student support varies with the term of each grant. Typically, students spend at least six months to one year at the research center working under faculty supervision with NASA researchers. Once the students complete the project, they return to their universities to write up the results. Eleven students (including four undergraduates who worked only at the university) were enrolled in the program in 1980, along with six faculty members. Program officials planned to expand the program to include thirty to forty students per year.

Funding

fiscal year	(in thousands)
1978 (actual)	$ --
1979 (actual)	--
1980 (actual)	500
1981 (estimate)	750
1982 (request)	1,982

Percentage engineering education

According to program officials, this program is entirely devoted to aeronautical engineering.

Name

Graduate Student Researchers Program

Organizational location

National Aeronautics and Space Administration
Office for External Relations
University Affairs Office
Academic Affairs Division

Legislative mandate

National Aeronautics and Space Act of 1958, 42 U.S.C. 2473. The Act, as interpreted by NASA, serves as broad enabling legislation for training and research agreements with universities. The Act provides for

> participation by the scientific community in planning scientific measurements and observations . . . [and for] the widest practicable and appropriate dissemination of information.
>
> [The Act allows the agency] to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary . . . with any . . . educational institutions.

Objective

To increase significantly the number of highly trained scientists and engineers in aeronautics, space science, space applications, and space technology for the national aerospace effort.

History

The program was initiated in 1980 with 38 awards made to graduate students. Thirty-nine new awards were made in 1981 along with renewals of the 38 awards from the previous year.

Description

NASA research centers select doctoral level students for the program on the basis of the student's academic qualifications, the quality of the research proposal, the relevance of the research to NASA's interests, and the ability of the student to utilize NASA's research facilities. Each student receives a stipend of $8,000 and a subsistence allowance of $3,000. A travel allowance of $2,000 is set aside for the student's advisor to travel to the center. Awards may be funded for periods of up to 3 years.

Funding

fiscal year	(in thousands)
1978 (actual)	$ --
1979 (actual)	--
1980 (actual)	385
1981 (estimate)	785
1982 (request)	1,200

Percentage engineering education

In 1980, 39.5 percent of the participants were in engineering fields, predominantly in aeronautical and mechanical engineering.

Name

Summer Faculty Fellowship Program

Organizational location

National Aeronautics and Space Administration
Office for External Relations
University Affairs Office
Academic Affairs Division

Legislative mandate

National Aeronautics and Space Act of 1958, 42 U.S.C. 2473. The Act, as interpreted by NASA, serves as broad enabling legislation for training and research agreements with universities. The Act provides for

> participation by the scientific community in planning scientific measurements and observations . . . [and for] the widest practicable and appropriate dissemination of information.
>
> [The Act allows the agency] to enter into and perform such contracts, leases, cooperative agreements, or other transactions as may be necessary . . . with any . . . educational institutions.

Objective

To further the professional knowledge of qualified engineering and science faculty members, to enrich research and teaching activities at the participants' institutions, and to contribute to NASA's research objectives.

History

The program was initiated in 1964 with fellowships awarded to 42 faculty members for aeronautics and space research. In 1966, an Engineering Systems Design Program was added. This program continued until 1980 when it was replaced with a Technology Feasibility Study program.

Description

NASA selects fellows for 10 week research projects. Programs are operated jointly by NASA research centers and universities. The American Society for Engineering Education supervises the program and provides coordination between various institutions and NASA. Faculty fellows conduct research in collaboration with NASA personnel and other faculty members. Special courses, seminars, workshops, and lectures are offered. A stipend of $450 per week and a travel allowance are provided to the participants. In 1980, NASA selected 211 faculty members to participate in the Aeronautics and Space Research programs at seven NASA centers and 20 faculty members for the Technology Feasibility Study program.

Funding

fiscal year	(in thousands)
1978 (actual)	$ 851
1979 (actual)	1,030
1980 (actual)	1,580
1981 (estimate)	1,500
1982 (request)	1,500

Percentage engineering education

From 1976 to 1980, 41.2 percent of program participants were in engineering fields, including civil, chemical, electrical, industrial, mechanical, and environmental engineering.

NATIONAL SCIENCE FOUNDATION

Name

Development in Science Education (DISE)

Organization location

Science and Engineering Education Directorate
Science Education Development and Research Division

Legislative mandate

National Science Foundation Act of 1950, as amended, 42 U.S.C. 1862.

The legislation states that "The Foundation is authorized and directed to initiate and support . . . science education programs at all levels. . . ."

Objectives

To develop and evaluate course materials and curricula, delivery modes, and technologies that can improve science instruction at all levels.

History

NSF has supported science education curriculum development since the mid-1950s. Prior to 1965, all Foundation activity in this area was conducted by one section of the Division of Scientific Personnel and Education. From 1965 to 1975, several parallel divisions existed, each of which funded various types of projects at a particular educational level (i.e., precollege, higher education). The Science Education Development and Research (SEDR) Division was formed in 1975 recentralizing activity for all education levels in one division. This reorganization was carried out in response to congressional criticism of NSF involvement in precollege curriculum development. 1/ By 1979, all organizational distinction according to educational level was dropped. Since that time, funding has been provided on purely functional lines in two program elements: Research in Science Education (RISE) and Development in Science Education (DISE). (RISE has had very few projects with direct impact on the engineering field so it will not be further discussed.)

Description

The DISE program competitively awards grants to institutions of higher education and other nonprofit organizations to originate, develop, and experiment with significantly new ideas that have potential for substantially improving science and engineering education at any level. Preference is shown for proposals that are

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1/A description of the reorganization and the reasons behind it can be found in: Paldy, Lester G., "Science Education Research and NSF: A Hesitant Alliance" in The Journal of College Science Teaching, March 1977, pp. 244-247.

likely to be of benefit to many people, that are cost-effective, and that make provision for dissemination of results.

Each year, areas of emphasis are selected to focus resources. In 1980 and 1981, five such areas were identified: Science for the Early Adolescent; Improving Access to Careers in Science for Women, Minorities, and the Physically Handicapped; Science Literacy, and Science, Technology and Society; Technology for Science Education; and New Knowledge and New Skills--Education for Productivity. Included in the last area was a $306,000 grant to support formation of a national consortium of universities and industries dedicated to modernizing the engineering and applied science curricula for the 1980s. In 1980, 52 awards were made in all at an average of $156,000 each.

Funding

fiscal year	(in thousands)
1978 (actual)	$6,010
1979 (actual)	8,185
1980 (actual)	8,105
1981 (estimated)	4,100
1982 (request)	0

Percentage engineering education

According to program officials, seven of the 1980 DISE grants were in engineering education, involving approximately 13.6 percent of total funds.

Name

Comprehensive Assistance to Undergraduate Science Education (CAUSE)

Organizational location

National Science Foundation
Science and Engineering Education Directorate
Science Education Resources Improvement Division

Legislative mandate

The National Science Foundation Authorization Act of 1976, Section 2(d), 89 Stat. 429. The Act states that NSF "is authorized and directed to conduct" a CAUSE program with "the purpose of strengthening the science education capabilities of predominately undergraduate educational institutions. . . ."

Objective

To strengthen and improve the quality of undergraduate science and engineering instruction in 2-year and 4-year colleges and universities and to enhance institutional capability for self-assessment and updating of science and engineering programs.

History

An earlier program of support to undergraduate science education, the College Science Improvement Program (COSIP), was initiated in 1967 and terminated in 1973. CAUSE was initiated by the House Committee on Science and Technology after public hearings, in which the need for support for the improvement of undergraduate science education was stressed. In 1976, the program's first year, 59 grants were awarded at a funding level of $10.1 million.

Description

NSF awards grants by competition to institutions of higher education that have formal programs in science and that award either the associate or baccalaureate degree. Projects to improve instruction for science majors, science teaching majors, nonmajor students, or students preparing for technological careers are all eligible. Institutions must submit an assessment of what is needed and a formulation of specific activities to meet those needs. The resulting comprehensive plans typically include refinement of course materials, purchase of specialized equipment, development of staff, and renovation of teaching facilities. CAUSE awards vary greatly in size; the average for the 66 made in 1980 was $197,200. The maximum award size is $250,000, and NSF will supply no more than two-thirds of the cost of any project. Program officials stated that approximately 40 percent of the program funds directed to engineering education are expended for curriculum development, 25 to 30 percent for instructional equipment, and 5 percent for faculty development.

Funding

fiscal year	(in thousands)
1978 (actual)	$13,468
1979 (actual)	13,519
1980 (actual)	13,291
1981 (estimate)	7,904
1982 (request)	0

Percentage engineering education

In 1980, 16.1 percent of program funds were expended in engineering, according to program officials. Six projects were targeted exclusively to engineering, along with portions of nine others.

Name

Instructional Scientific Equipment Program (ISEP)

Organizational location

National Science Foundation
Science and Engineering Education Directorate
Science Education Resources Improvement Division

Legislative mandate

National Science Foundation Act of 1950, as amended, 42 U.S.C. 1862. The legislation states: "The Foundation is authorized and directed to initiate and support . . . science education programs at all levels. . . ."

Objective

To assist undergraduate institutions to keep pace with changes in teaching requirements imposed by developments in science and engineering research, specifically:

--to encourage and support the introduction of modern equipment to improve science and engineering laboratory instruction, and

--to encourage and support incorporation of current educational technology into undergraduate science and engineering instruction.

History

The ISEP program was initiated in 1962 under the title "Undergraduate Instructional Scientific Equipment program" (UISE). It was begun by NSF as part of the increase in Federal educational assistance that took place after Sputnik. The program reached its highest funding level in 1964 when 1,163 grants were made for $8,942,000. Over the past decade, budget requests for ISEP have declined, with proposals for zero funding or rescission occurring frequently. The Congress, however, has provided funding in every year except 1971. [1]

Description

The Foundation competitively awards grants to 2- and 4-year colleges for the purchase of up-to-date instructional equipment. Grants are intended to provide assistance in improving instruction in a specific subject. They are not intended to alleviate an institution's general need for equipment. Grants are limited to a maximum of $20,000 and require matching funds from the institution. In 1980, 215 awards were made.

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[1] The history of ISEP is described in Pino, Lewis N., "Developmental Funding for Higher Education: A Case Study," Grants Magazine, vol. 3, no. 4, Dec. 1980, (Plenum Publishing Co.)

Funding

fiscal year	(in thousands)
1978 (actual)	$3,740
1979 (actual)	3,448
1980 (actual)	2,771
1981 (estimate)	3,200
1982 (request)	0

Percentage engineering education

In 1980, 39 grants were awarded in engineering, involving 19.6 percent of total funds.

Comments

A new $25 million instructional equipment program was proposed for 1982 by the Carter Administration. It proposed the awarding of large grants (up to $500,000) to improve the quality of technically educated manpower by assisting in the acquisition of costly, sophisticated instructional equipment for undergraduate engineering and computer science education. This program was eliminated from the 1982 budget request.

Name

Local Course Improvement (LOCI)

Organizational location

National Science Foundation
Science and Engineering Education Directorate
Science Education Resources Improvement Division

Legislative mandate

National Science Foundation Act of 1950, as amended, 42 U.S.C. 1862. The legislation states that "The Foundation is authorized and directed to initiate and support . . . science education programs at all levels. . . ."

Objective

To help individual college-level science and engineering departments incorporate scientific and educational advances, specifically:

--to provide institutions with the capacity for introducing scientific or technological developments into their courses and for preparing improved approaches to the presentation of scientific concepts, and

- --to improve the pre-service training of prospective teachers of science and mathematics through the modification of specific courses.

History

The Foundation established this program in 1977, after operating a small pilot program for a year under the "Restructuring Undergraduate Learning Experience" or "RULE" program. The initial funding level was just over $2 million.

Description

LOCI competitively awards grants to undergraduate faculty members for short-term local projects to design, prepare, and implement specific course materials or teaching strategies. All types and levels of college science students may be addressed, including education majors. Maximum grant size is $30,000. Up to two-thirds of the total cost of a project may be provided by NSF. In 1980, 125 awards were made. Ten to twelve percent of program funds are expended for the purchase of instructional equipment.

Funding

fiscal year	(in thousands)
1978 (actual)	$2,522
1979 (actual)	2,955
1980 (actual)	2,908
1981 (estimate)	2,800
1982 (request)	0

Percentage engineering education

Twenty-three projects were devoted to engineering education, involving 18.9 percent of 1980 grant funds.

Name

Graduate Fellowship Program

Organizational location

National Science Foundation
Science and Engineering Education Directorate
Scientific Personnel Improvement Division
Graduate Programs

Legislative mandate

National Science Foundation Act of 1950, as amended, 42 U.S.C. 1862.

The legislation states: "The Foundation is authorized and directed to award . . . scholarships and graduate fellowships in the mathematical, physical, medical, biological, engineering, social, and other sciences. . . ."

Objective

To provide support for a limited number of the Nation's most able students to study science and engineering in order to provide a cadre of highly trained scientists for the future.

History

The Foundation began funding graduate fellowships in 1952. The number awarded each year has changed dramatically during the program's history. In the late 1950s, it was increased from 300 to 1,000 new starts per year in response to Sputnik. This level of effort was maintained until the early 1970s when the program was cut by 50 percent. Over the past several years, new starts have declined from 550 to 450 per year.

Description

The Foundation makes awards directly to students on the basis of merit. The awards are renewable for up to 3 years. In 1980, 1,515 students participated in the program, of which 460 were new starts. Students received stipends of $4,320, with an associated $3,400 institutional allowance. The former amount increased to $4,800 in 1980. Seventy to seventy-five percent of program awardees obtain their doctorates.

Funding

fiscal year	(in thousands)
1978 (actual)	$11,046
1979 (actual)	11,406
1980 (actual)	10,905
1981 (estimate)	11,400
1982 (request)	8,800

The 1982 budget provides sufficient funds to continue fellowships awarded through 1981 but does not allow for any new starts.

Percentage engineering education

Sixty-six of the fellowships offered in 1980, or 14.3 percent of the total, were in engineering.

Comments

The 1982 budget prepared by the Carter Administration proposed a new $3 million program of Engineering and Computer Science Graduate Traineeships. This proposal was deleted from the 1982 Reagan

Administration budget. Student stipends are slated to increase to $6,900 in 1982, with institutional allowances rising to $4,000.

Name

Science Faculty Programs

Organizational location

National Science Foundation
Science and Engineering Education Directorate
Scientific Personnel Improvement Division
Faculty Oriented Programs

Legislative mandate

National Science Foundation Act of 1950, as amended, 42 U.S.C. 1862. The legislation states: "The Foundation is authorized and directed to initiate and support . . . science education programs at all levels. . . ."

Objective

To increase the subject matter competency of science teachers in order to provide high quality, up-to-date instruction in the sciences for all students.

History

NSF has sponsored science faculty development since the early 1950s. The nature and extent of programming in this area have varied considerably over the past 30 years. Three main program types have been sponsored:

--short courses and institutes: The initial NSF effort was the summer institute program, which ran from 1953 to 1973. Two programs of this type have been in operation recently: Chautauqua Short Courses and College Faculty Conferences. The former was initiated in 1970 and the latter in 1980.

--faculty research participation: NSF first funded this type of activity as Research Participation for College Teachers from 1959 to 1970. The Industrial Research Participation program was initiated in 1979 and was reinstated in 1981 after a 1-year suspension.

--faculty fellowships: NSF has funded fellowships for science faculty annually since 1957, with the exception of 1972 and 1973. This program is currently called Science Faculty Professional Development.

The College Faculty Conferences program was suspended and the scope of the Chautauqua Short Courses program was reduced in 1981 due to budgetary constraints. (See "Comments.")

Description

During 1980 and 1981, the Science Faculty Program has had four elements:

--Chautauqua Short Courses: Through this program new knowledge, concepts, and techniques are communicated to faculty in ways that are expected to be immediately beneficial to their teaching. The American Association for the Advancement of Science (AAAS) develops the program of courses and jointly administers national aspects of the program with the Support Field Center, which is located at the University of Georgia. NSF awards 3-year grants on a competitive basis to institutions of higher education to act as field centers where courses will be held. (Currently 12 centers exist.) Faculty members apply to the centers and are competitively selected for participation. Participants are provided with accommodations, but they or their institutions must pay all other costs. Courses meet for a total of 4 days--2 in the fall and 2 in the spring. Between these sessions, participants work on course-related projects. One hundred and twenty-one sessions were held in 1980.

--College Faculty Conferences: This program is designed to bring new knowledge into the undergraduate curriculum. Grants are awarded on a competitive basis to any organization that shows itself capable of carrying out a successful program. In turn, the grantee competitively selects undergraduate faculty participants. NSF supplies 80 percent of participant costs with the expectation that the balance will be supplied by participants or their institutions. Activity consists of 2 to 5 weeks of intensive study on recent scientific advances or newly emerging subject fields with incorporation into undergraduate curricula in mind. Nine conferences were sponsored in 1980.

--Industrial Research Participation: This program is designed to offer new perspectives on industrial research activity to faculty members, thereby improving their students' ability to meet employment requirements. Grants are awarded by competition to industrial, governmental, or nonprofit research facilities. Successful awardees then select faculty participants. The Foundation supplies a participant support allowance of $500 per participant per week for up to 10 weeks of summer research activity at the grantee's research facilities. Eighteen grants were awarded in 1979.

--Science Faculty Professional Development: Undergraduate faculty members compete for awards directly from NSF. Grants consist of a salary-matching stipend and an activities support allowance of $150 per month to the institution at which the Fellow does research. Awards are given for work that will benefit the applicants in their development as science teachers. Tenure is from 3 to 12 months at an institution of the applicant's choice. Seventy fellowships were awarded in 1980.

Funding

fiscal year	(in thousands)
1978 (actual)	$3,386
1979 (actual)	3,034
1980 (actual)	3,212
1981 (estimate)	3,000
1982 (request)	0

Percentage engineering education

Approximately 6.7 percent of total program funding was devoted to engineering education in 1980. Percentage engineering education for the four elements individually is as follows:

--Chautauqua Short Courses: In 1980, 4 out of 121 sessions were in engineering (3.3 percent).

--College Faculty Conferences: In 1980, one out of nine awards was in engineering, involving 11.7 percent of funds, according to program officials.

--Industrial Research Participation: In 1979, 18 grants were awarded. Most of these were multi-disciplinary and 14 included engineering. Engineering education absorbed 34.4 percent of total funds.

--Science Faculty Professional Development: In 1980, 6 out of 70 fellows were in engineering. Eight percent of funding was expended on engineering education, according to program officials.

Comments

In the past 2 years, there has been some disagreement between NSF and the Congress as to relative priorities within Science Faculty Programs. The 1980 budget submission proposed redirection of resources within the overall program, eliminating Science Faculty Professional Development in favor of Industrial Research Participation and College Faculty Conferences. NSF defended this shift by pointing out that, under the new system, 500 teachers would be served, as opposed to 130 under the old system. NSF argued that cost-effectiveness would be increased and that the time-lag between assimilation of new knowledge by teachers and its dissemination in the classroom would be decreased. The Congress rejected NSF's proposed approach. The conference report issued by the authorization committees directed the Foundation to use only 20 percent of its funds for a pilot program of College Faculty Conferences, while devoting the remainder to Science Faculty Professional Development, which could include the option of placement with industry. Industrial Research Participation was suspended for 1980 as a result of these requirements. The report also directed NSF to undertake a study of these programs for presentation with the fiscal year 1981 funding request.

The report that NSF issued gave further, detailed support to its 1980 position. The authorization committees remained unconvinced, however. The fiscal year 1981 Authorization Act stipulated that no less than $2.4 million be available for fellowships. A final appropriation of only $3 million for all faculty programs forced suspension of College Faculty Conferences for 1981 and reduction in Chautauqua Short Courses, which had until this time remained unaffected. The House Committee on Science and Technology summarized opposition to the NSF plan as follows:

> [The Science Faculty Fellowships program] is one of the programs most highly valued by undergraduate science faculty as one of the few sources of funding for time spent away from the home campus to improve the teaching effectiveness of the award recipient . . . The NSF argument that this change will make the same amount of money available to far more awardees fails to take into account the very substantial reduction in the benefits available to each awardee.

Name

Undergraduate Research Participation (URP)

Organizational location

National Science Foundation
Science and Engineering Education Directorate
Scientific Personnel Improvement Division
Student Oriented Programs

Legislative mandate

National Science Foundation Act of 1950, as amended, 42 U.S.C. 1862. The legislation states: "The Foundation is authorized and directed to initiate and support . . . science education programs at all levels. . . ."

Objective

To help assure the continued scientific strength of the Nation, specifically:

--to train a modest number of the most talented students in the sciences,

- --to offer talented students science learning opportunities beyond those normally available, and

- --to make available to students firsthand experience in the research process.

History

This program was initiated in 1958 to encourage undergraduate students to pursue scientific careers by providing them with research experience. The program reached its peak level in the mid-1960s when nearly $7 million per year was awarded. The Student-Originated Studies (SOS) program, which allowed small groups of students to propose and conduct their own research projects, was operated as an independent program from 1971 to 1980, but was integrated into the URP program in 1981. NSF requested termination of the program for 1979, with funds to be transferred for the most part into the Comprehensive Assistance to Undergraduate Science Education (CAUSE) and Minority Institutions Science Improvement (MISIP) programs. This change was requested in order to bring funding into line with reordered priorities. NSF argued that the improved supply of scientists made motivational programs of this type a low priority and proposed that more emphasis be given programs like CAUSE and MISIP, which address the quality of science education available to all college students. The Congress disagreed with this proposal and asserted its continuing interest in early research training for highly talented future scientists. NSF was mandated to continue the program.

Description

NSF awards grants on a competitive basis to undergraduate faculty members or active research scientists from nonprofit research institutions or field stations. Three types of projects are supported. The most common involves students working with faculty members at the grantee institution. The second type of project--Industrial URP--involves students working with scientists in industrial settings. In both types of projects, the principal investigator selects the student participants. The third type is Student Initiated Research, which replaces the SOS program. (See "History" above.) In this option, teams of two or three undergraduates propose research to be conducted in collaboration with a faculty member. Research is conducted during the summer with a student stipend of $1,200 for 10 to 12 weeks participation. In 1980, 184 grants were made in all.

Funding

fiscal year	(in thousands)
1978 (actual)	$2,895
1979 (actual)	2,936
1980 (actual)	2,832
1981 (estimate)	3,000
1982 (request)	0

Percentage engineering education

In 1980, URP and SOS were separate programs. In SOS, 5 of 58 projects were in engineering, involving 8 percent of funds. In URP, 15 of 126 projects were wholly or partially in engineering, involving 10.4 percent of funds. Approximately 9.5 percent of total program funding was devoted to engineering education in 1980.

STUDENT FINANCIAL ASSISTANCE PROGRAMS

The Federal Government annually provides billions of dollars to post-secondary students to aid in financing their educations. Federal expenditures on aid to students have grown from $250 million in 1965, when the Higher Education Act consolidated existing loan and work-study programs and initiated the first need-based grant program, to a level of approximately $5.2 billion in 1980.

The Federal Government has two goals in providing such funds: to promote equity by lowering the financial barriers that prevent individuals from obtaining post-secondary education and to provide a measure of choice in selecting a post-secondary institution.

Six programs are involved: Pell Grants (formerly Basic Educational Opportunity Grants (BEOG)), Supplementary Educational Opportunity Grants (SEOG), State Student Incentive Grants (SSIG), College Work-Study (CWS), National Direct Student Loans (NDSL), and Guaranteed Student Loans (GSL). Short descriptions of these programs follow. Changes instituted by the Education Amendments of 1980 1/ and by the Post-Secondary Student Assistance Amendments of 1981 2/ are throughout the discussion.

PELL GRANTS (FORMALLY BASIC EDUCATIONAL OPPORTUNITY GRANTS (BEOG))

The Pell Grants program is the foundation of Federal financial aid for undergraduate students who demonstrate financial need. Students apply directly to the Government for grants that may be used at any eligible institution (of which there are more than 7,000). Grants are limited to one-half the cost of education; in 1980, the maximum award was $1,750 per year. It was decreased to $1,670 for 1981. Grants are awarded on an entitlement basis; students are assigned an eligibility index after family financial resources are analyzed. This eligibility index is then compared to the cost of attending a particular institution to determine the grant amount. In 1980, approximately 2.6 million students received assistance in this program. Budget authority was $2,346,000,000.

SUPPLEMENTAL EDUCATIONAL OPPORTUNITY GRANTS (SEOG)

Supplemental Grants act as supplemental awards to Pell Grants. Funds are distributed among the States by a formula based on the relative number of undergraduates in each State. These funds are then distributed among applicant institutions based on amounts previously received and the financial needs of the student body. Students apply to the institution for awards, which are distributed

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1/Public Law 96-374, 94 Stat. 1367, 20 U.S.C. 1001 note.

2/Public Law 97-35, 95 Stat. 450, 20 U.S.C. 1001 note.

according to financial need. Maximum award size in 1980 was $1,500 per year. The Education Amendments of 1980 raised this limit to $2,000 for 1981. In 1980, approximately 586,000 students received assistance in this program. Budget authority was $370,000,000.

STATE STUDENT INCENTIVE GRANTS (SSIG)

This program is designed to foster the State-Federal partnership in assisting financially needy students. Funds are distributed among the States in accordance with the relative numbers of post-secondary students in attendance in each State and previous expenditure levels. States must match Federal funds by 100 percent. In most cases, students apply directly to the State for awards, which may then be used at participating institutions. Awards are determined on the basis of need. The maximum yearly award was $1,500 in 1980. The Education Amendments of 1980 increased this amount to $2,000 for 1981 and expanded eligibility to include graduate students. Approximately 307,000 students benefited from this program in 1980. Budget authority was $76,750,000. Because this program requires 100 percent State matching funds, the amount actually received by students was $153,500,000.

COLLEGE WORK-STUDY (CWS)

The purpose of the CWS program is to promote the part-time employment of students who are in need of earnings to pursue post-secondary education. Funds are allocated among the States on a formula basis. The level of funding that each school receives depends upon past expenditure and student need. Students apply directly to the institution for participation in the program. Each institution specifies which application form must be used and determines the amount of the CWS award. Federal grants pay up to 80 percent of a student's wages, with the remaining 20 percent paid by the employer. No limits are placed on the amount of assistance a student may receive. In 1980, approximately 976,000 students, nearly 99 percent of them at the undergraduate level, participated in this program. Budget authority was $550,000,000. The amount received by students was about $606,836,000 due to the addition of matching funds.

NATIONAL DIRECT STUDENT LOANS (NDSL)

The NDSL program was instituted to assist in establishing and maintaining revolving loan funds at institutions of higher education so that financially needy students may be provided with low-interest loans. Generally, the institutional capital contribution equals one-ninth of the Federal contribution. Funds are allocated among States on the basis of the relative number of higher-education students in each State. Allocations to institutions within a State are made on the basis of approved applications.

Students apply directly to the educational institution for participation in this program. Awards are determined on the basis of need. In 1980, the maximum aggregate amount that a graduate student could borrow was $10,000. In the case of a student who had completed two academic years of a program leading to a bachelor's degree, the indebtedness limit was $5,000. For a student who had completed less than 2 years, the limit was $2,500. For 1981, the Education Amendments of 1980 changed these ceilings to $12,000, $6,000, and $3,000, respectively. The interest rate was 3 percent in 1980 and 4 percent in 1981. It will be 5 percent in 1982. Cancellation of loans is possible for those obtaining employment in certain teaching or military positions or in the Head Start program.

In 1980, approximately 861,000 students, nearly 99 percent of them undergraduates, received assistance through this program. Budget authority was $286,000,000. Loan volume was approximately $710,817,000.

GUARANTEED STUDENT LOANS (GSL)

The GSL program makes low-interest, long-term loans available for undergraduate and graduate education. The loans are made by over 17,000 participating banks and other lenders to assist students at over 8,000 participating institutions. Participating lenders use private capital when making loans under this program. Federal funds are used to insure and reinsure student and parent loans and to provide non-need-related interest subsidies and "special allowance" payments. In almost all States, the program is administered through State and private nonprofit guarantee agencies that serve as intermediate loan insurers, default collectors, and providers of various services to lenders. In the remaining States, and in certain special circumstances, loans are directly insured by the Department of Education.

The Government pays the interest obligation on student loans (but not on "auxilliary" loans) for borrowers while they are in school and during the grace and deferment periods. A special interest allowance, derived from average 91 day Treasury bill yields, is paid to lenders on their outstanding loan volume. The Government is liable for default costs. Noninterest bearing advances are made to guarantee agencies to support their insurance of loans. Generally, loans are 100 percent reinsured by the Federal Government. The Government also pays administrative allowances to participating schools and guarantee agencies based on annual volume. A 1981 survey indicated that graduate students received up to 20 percent of loans, involving up to 30 percent of volume.

In 1980, the interest rate on all loans was seven percent, and limits on total indebtedness were $7,500 for undergraduates and $15,000 for graduates. Budget authority was $1,609,344,000. This Federal expenditure enabled 2.3 million students to receive approximately $4.8 billion in loans.

SUMMARY

Overall, the Federal Government's 1980 student financial assistance budget authority was $5,238,094,000. These funds generated about $9.1 billion in actual assistance to students with more than half of this total derived from the GSL program. Statistics are not available to indicate precisely what portion of this effort benefitted engineering students as a subset of the total student population. However, we can provide a reasonable approximation. According to ED, there were about 12,115,000 post-secondary students in the country in 1980. According to the Engineering Manpower Commission, nearly 438,000 of these were engineering students. 1/ The percentage of engineering students in the total student population, then, was approximately 3.6. Assuming that engineering students are about as likely to receive assistance as others, we may estimate that 3.6 percent of the budget authorization, or about $189,000,000, was devoted to engineering students. This expenditure generated about $327,000,000 in actual assistance.

According to ED's 1982 budget submission, over one-third of the Nation's students have received assistance from the programs described in this section. We can, therefore, conclude that at least 146,000 (or one-third of all engineering students) were assisted by these programs in 1980.

CHANGES: 1980-1982

Significant changes have taken place since 1980, particularly in the GSL program, that result in higher levels of student financial assistance for 1982.

The Education Amendments of 1980 raised GSL interest rates to 9 percent for new borrowers and increased total indebtedness limits to $12,500 for dependent undergraduates, $15,000 for independent undergraduates, and $25,000 for graduate students (effective January 1, 1981). Also, the parents of dependent undergraduates were made eligible for up to $15,000 in auxiliary loans under the new Parent Loan for Undergraduate Students (PLUS) program.

The Post-Secondary Student Assistance Amendments of 1981 instituted several important changes. Effective October 1, 1981, students whose families have an adjusted gross income of over $30,000 are subject to an analysis of need and will qualify for GSL interest benefits only to the extent of unmet need. Also, a loan origination fee of 5 percent of the loan volume must be paid on all student loans made after August 1981. The ceiling for independent undergraduates was reduced to $12,500.

1/Engineering Manpower Commission of the American Association of Engineering Societies, Inc.; Engineering and Technology Enrollments, Fall 1980; Part I: Engineering. New York, 1980. p. 6.

The liberalization of GSL for 1981, coupled with impending limitations for 1982 and the increasing attractiveness of the program's low interest rates, caused loan volume in 1981 to rise to about $7.8 billion.

While student loan terms were made somewhat more stringent for 1982, another aspect of the program was made more liberal. The PLUS program was expanded to become "Auxiliary Loans to Assist Students," wherein graduate students and parents were made eligible for an additional $15,000 in loans. Under this program, independent undergraduates may borrow up to a total combined indebtedness limit (auxiliary loans and student loans) of $12,500. Auxiliary loans will be made at a rate of 14 percent and no origination fee will be charged. This will drop to 12 percent if 91-day Treasury bill rates fall below 14 percent for 12 months in succession.

According to program officials, the slight decline in student loans that can be expected as a result of more stringent limitations imposed for that portion of the program will be more than offset by new borrowing in the auxiliary loans program. Overall, GSL budget authority is expected to rise by 71 percent from 1980 to 1982, while loan volume increases to $9.5 billion, which is about double the 1980 figure.

Most other student financial assistance programs are slated for level funding from 1980-1982. Two exceptions are Pell Grants, which will increase by about 15 percent, and NDSL, which will decline by about 35 percent.

The 1982 funding request for student financial assistance was $6,421,750,000, which is a 23 percent increase over 1980 budget authority. This funding will make possible the distribution of approximately $13.8 billion in financial assistance, which is 52 percent higher than the 1980 level.

FEDERAL PROGRAMS AND ACTIVITIES COMMON TO MORE THAN ONE AGENCY

This appendix presents information on three Federal cross-agency activities that provide support for engineering education. They are

--Federal research and development grant funding, which provides student support and instructional equipment;

--The Federal Cooperative Education Employment Program, which provides student support; and

--The disposal of used Federal property, which provides instructional equipment.

FEDERAL RESEARCH AND DEVELOPMENT FUNDING

Student support

Many engineering students receive support through Federal research and development (R&D) funding. We attempted to determine how many students were supported by the R&D activities of the Federal agencies included in our scope. Generally, officials in the agencies examined were unable to provide information about the number of students supported. Officials told us either that no data are collected regarding students supported or that data on student support are collected on grant applications, but are not aggregated. The National Science Foundation (NSF) does collect data regarding the number of students supported through its research programs; however, student data are aggregated by research programs and not by field of study. NSF data do not differentiate full- and part-time or masters- and doctoral-level students.

One source of data on graduate student support through Federal R&D grant funding is the annual Survey of Graduate Science Students conducted by the Science Resources Studies Division of the National Science Foundation. The survey collects data from the science and engineering departments of masters and doctorate degree-granting institutions. Data are collected on the number of full-time graduate students in engineering, including the type (e.g., fellowship, traineeship, research assistantship) and source (Federal, non-Federal, self-support) of major support. Data do not differentiate between masters- and doctoral-level students. For the academic year 1980, NSF officials report that 6,901 engineering graduate students received support through research assistantships funded by civilian Federal sources. 1/ They provided the following breakdown:

1/National Science Foundation, Academic Science: Graduate Enrollment and Support, Fall 1980, NSF 81-330, Detailed Statistical Tables, Table IV-A-2, p. 165.

Source	Number of Students
National Institutes of Health	334
Other HEW	54
National Science Foundation	2,174
Other Federal sources	4,339
Total	6,901

The annual survey does not amass data regarding the amount of funding received by these students. No data are available regarding the number of undergraduates supported by Federal R&D grant funding or the amount of support received.

A number of Federal agencies have programs that utilize R&D funding primarily and explicitly as an instrument to provide support for students in particular fields. Several programs of this type that support engineering students were included in our scope and are described in detail in appendix I. In 1980, about 300 graduate engineering students were supported in these programs. 1/ Subtracting this figure from the overall number above leaves a total of 6,600 students supported by other civilian R&D funds.

Instructional equipment

There is considerable Federal funding for providing R&D equipment to institutions of higher education. A NSF report commented on mechanisms for Federal funding of R&D equipment: "funds for equipment are provided to academic researchers in a variety of ways, but one of the most important is that which is provided either as part of a Federal research grant, or that granted specifically for equipment purchase." 2/ Because of the close link between research and training, especially at the graduate level, R&D equipment at universities and colleges is often used for instructional purposes.

NSF conducts an annual survey 3/ of federally financed capital expenditures 4/ for scientific and engineering facilities and equipment at universities and colleges. The survey includes

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1/This number includes 1979 data for the HHS National Research Service Awards program.

2/Science Indicators 1978: Report of the National Science Board, National Science Foundation, March 1979, p. 61.

3/National Science Foundation, Academic Science 1972-81: R&D Funds, Scientists and Engineers, Graduate Enrollment and Support, NSF 82-300, Detailed Statistical Tables, Table B-41, in press.

4/NSF includes as capital expenditures "(a) fixed equipment such as built-in equipment and furnishings; (b) movable scientific equipment such as oscilloscopes, pulse-height analyzers; (c) movable furnishings such as desks; (d) architect's fees, site work, facilities and equipment for research, development, and instruction. Data are gathered by field of science.

According to agency officials, the latest available data for 1980 indicates that $151,628,000 was provided by the Federal Government for capital expenditures. The survey reports that a total of $21,440,000 was spent for engineering.

THE FEDERAL COOPERATIVE EDUCATION EMPLOYMENT PROGRAM

Since 1971, the Federal Government has formally operated a cooperative education employment program coordinated by the Office of Personnel Management in which many Federal agencies, except ED and NSF, participate. Students are employed in a variety of occupational groups at four educational levels: graduate, baccalaureate, associate, and high school. Cooperative education serves as both a recruitment vehicle for Federal agencies and as an educationally related work experience for the student participant.

OPM provides overall leadership and guidance for establishing cooperative education programs to Government departments or agencies that desire to enter into agreements with educational institutions. The initiative for these agreements is the responsibility of colleges and universities. OPM does not provide funding to participating institutions, agencies, or students. Student salaries are paid by their employing agencies.

In 1980, the 10 agencies included in our scope employed the following number of students in the "Engineering and Architecture" category:

Agency	Graduate	Baccalaureate
USDA	0	219
DOC	4	146
ED	0	0
DOE	0	53
HHS	0	31
DOI	10	119
DOT	0	136
EPA	0	132
NASA	0	805
NSF	0	0
Total	14	1,641

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extension of utilities, and the building costs of service functions such as integral cafeterias and bookstores of a facility; (e) facilities constructed to house separate components such as medical schools and teaching hospitals; and (f) special separate facilities used to house scientific apparatus such as accelerators, oceanographic vessels, and computers."

OPM officials estimate that more than 95 percent of the "Engineering and Architecture" occupational group students are in engineering fields.

One other Federal program that also involves cooperative education is included with the programs contained in appendix I. This is the Cooperative Education Program of the Education Department. The Department provides funds to higher education institutions to develop administrative structures for cooperative education programs. This program is independent of the employment program operated by OPM.

THE DISPOSAL OF USED FEDERAL PROPERTY

The Federal Government annually disposes of used personal property 1/ with a total original acquisition cost 2/ in the billions of dollars. Some of this property is transferred to colleges and universities, with engineering, as well as other disciplines, benefitting. Three mechanisms are used for disposing of most of the property made available to engineering departments. These are located at the General Services Administration (GSA), NSF, and the Department of Energy (DOE).

GSA surplus property donation program

Federal property that is declared surplus 3/ may be set aside for donation through State Agencies for Surplus Property (SASPs) to public agencies for designated public purposes or to nonprofit educational and public health organizations and certain programs for older individuals. SASP representatives screen Federal property and request items that would be useful in their States. GSA is responsible for fair and equitable distribution among States, while SASPs are responsible for fair and equitable distribution within States.

SASPs pay for transportation expenses relating to the donated property. In turn, most SASPs collect a service charge from donees to recover these expenses. In 1980, SASPs distributed $243,633,000 in used personal property to donees. Of this amount, $118,707,000 was used for educational purposes. No further breakdowns are available as to field or level of education.

1/Personal property means property of any kind, except real property, records, and certain naval vessels.

2/All dollar amounts in this discussion will be expressed in terms of original acquisition values.

3/Surplus property is property determined to be unneeded by the entire Federal Government.

NSF's transfer of excess scientific equipment

Any Federal agency may obtain excess 1/ personal property for the purpose of providing it to their grantees. Generally, agencies wishing to do so must pay 25 percent of the original acquisition cost to the U.S. Treasury. NSF, however, is exempted from this requirement with regard to scientific equipment 2/ that has a unit acquisition cost of $1,000 or more. GSA is also authorized to allow transfer (without reimbursement) of items that are not classified as scientific equipment or which have an acquisition cost of less than $1,000, provided NSF certifies that an item is "a component part of or is related to a piece of scientific equipment or is an otherwise difficult to acquire item needed for scientific research.", Grantees may obtain property up to a total acquisition cost equal to the dollar value of the grant under which they are filing a requisition. Grantees must pay all transportation costs; grant funds may be used for this purpose.

According to program officials, 234 schools received $24,317,000 in used scientific equipment in 1980. Engineering departments or schools obtained $2,917,000 (12 percent) of the total.

DOE used energy-related laboratory equipment grants program

This program is conducted under the authority of the Atomic Energy Act of 1954 (Public Law 83-703) and subsequent legislation. It also serves to advance DOE's responsibility under the Energy Reorganization Act of 1974 (Public Law 93-438) to help ensure an adequate supply of energy research and development manpower by supporting appropriate educational activity. DOE makes grants of used energy-related laboratory equipment that is excess to the requirements of DOE offices, facilities, and contractors to nonprofit institutions of higher learning for use in energy-oriented education programs. Lists of available equipment are maintained at DOE field offices for review by potential donees. Interested colleges and universities submit grant proposals for desired items, detailing how the equipment would be used. Equipment is awarded on a first-proposal received first-qualified basis. Grantees must pay

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1/Excess property is property determined to be unneeded by the Federal agency having possession of it; however, it may be needed by one or more other Federal agencies.

2/Scientific equipment is property which falls within certain Federal supply classification groups; e.g., Group 43 (pumps and compressors), Group 59 (electrical and electronic equipment components), Group 66 (instruments and laboratory equipment). See Federal Register, vol. 42, no. 203, p. 56001, for a complete list of classification groups.

transportation costs and are required to submit a report on the equipment's use and its effect on the institution's energy-oriented offerings.

In 1980, 22 schools received approximately 143 items with an original acquisition value of about $378,000. Program officials were unable to determine how much of this equipment went to engineering departments but estimated that it was a large portion of the total.

Table 17

Sources of Federal Support for Engineering Education (Budget Authority in Thousands)

Program by Agency	Total Program 1980 Actual	Total Program 1981 Actual	Total Program 1982 Request	Percent for Engineering	Engineering Portion 1980 Actual	Engineering Portion 1981 Estimate	Engineering Portion 1982 Request
Agency-Specific Programs							
Department of Agriculture							
Aid to Land-Grant Colleges (Bankhead-Jones)	$ 11,500	$ 11,500	$ 0	20.0%	$ 2,300	$ 2,300	$ 0
Department of Commerce							
Sea Grant Marine Education a/	1,563	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Department of Education							
Aid to Land-Grant Colleges (Morrill-Nelson) b/	2,700	2,800	0	22.0	594	616	0
Cooperative Education Program	15,000	23,000	20,000	11.5	1,725	2,645	2,300
Domestic Mining and Mineral and Mineral Fuel Conservation Fellowship Program	4,500	0	0	66.1	2,975	0	0
Rehabilitation Engineering Traineeship Program	104	125	n.d.	100.0	104	125	n.d.
Subtotal	$ 22,304	$ 25,925	$ 20,000	24.2%	$ 5,398	$ 3,386	$ 2,300
Student Financial Assistance Programs	5,238,094	6,180,750	6,421,750	3.6	188,571	222,507	231,183
Total (ED)	$5,260,398	$6,206,675	$6,441,750	3.7%	$193,969	$225,893	$233,483
Department of Energy							
University/Laboratory Cooperative Program	$ 3,200	$ 3,500	$ 3,600	20.0%	$ 640	$ 700	$ 720
University Reactor Fuel Assistance Program	1,700	1,400	1,600	50.0	850	700	800
Magnetic Fusion Energy Technology Fellowship Program c/	20	200	420	100.0	20	200	420

Solar Energy Meteorological Research and Training Site Program	1,000	1,080	1,120	20.0	200	216	224
DOE-ASEE Summer Faculty Program in Solar Thermal R&D	168	172	200	52.2	88	90	104
Total (DOE)	$ 6,088	$ 6.352	$ 6.940	30.0%	$ 1.798	$ 1,906	$ 2,268
Department of Health and Human Services							
National Research Service Awards (Predoctoral Institutional Training Grants) d/	$ 53,737	$ 64,390	$ 43,284	2.5%	$ 1,343	$ 1,610	$ 1,082
Department of the Interior							
State Mining and Mineral Resources and Research Institutes Program	$ 10,000	$ 9,629	$ 0	72.0%	$ 7,200	$ 6,933	$ 0
Department of Transportation							
U.S. Coast Guard Academy	$ 28,600	$ 31,000	$ 33,500	30.6%	$ 8,752	$ 9,486	$ 10,251
Aid to State Maritime Academies	11,459	7,530	10,180	50.0	5,730	3,765	5,090
U.S. Merchant Marine Academy	17,431	18,519	19,205	50.0	8,716	9,260	9,603
FHWA Fellowship and Scholarship Program	459	326	326	52.6	241	171	171
University-FHWA College Curriculum Program	29	29	n.d.	70.0	20	20	n.d.
Center of Excellence in Motor Vehicle Safety Research	312	550	n.d.	95.0	296	523	n.d.
Total (DOT)	$ 58,290	$ 57,954	$ 63,211	40.8%	$ 23,755	$ 23,225	$ 25,115

a/Total includes only the portions of Marine Education that are devoted to course development, research assistantships, internships, and Sea Grant Fellowships.
b/This percentage is based on 1979 data.
c/Budget figure represents start-up costs only in 1980.
d/This percentage is based on 1979 data.

Table 17 (Cont'd)

Program by Agency	Total Program				Engineering Portion		
	1980 Actual	1981 Actual	1982 Request	Percent for Engineering	1980 Actual	1981 Estimate	1982 Request
Environmental Protection Agency							
Air Pollution Traineeships Program	$ 380	$ 235	$ 0	50.0%	$ 190	$ 118	$ 0
Academic Grants in Solid Waste Technology	120	64	0	50.0	60	32	0
Academic Training Program in Water Pollution Control	438	0	0	75.0	329	0	0
Total (EPA)	$ 938	$ 299	$ 0	61.7%	$ 579	$ 150	$ 0
National Aeronautics and Space Administration							
Computational Fluid Dynamics Training Program	$ 375	$ 650	$ 700	72.0%	$ 270	$ 468	$ 504
Graduate Research Program in Aeronautics	800	900	1,100	100.0	800	900	1,100
Post-Baccalaureate Program in Aeronautics	500	750	1,982	100.0	500	750	1,982
Graduate Student Researchers Program	385	785	1,200	39.5	152	310	474
Summer Faculty Fellowship Program	1,580	1,500	1,500	41.2	651	618	618
Total (NASA)	$ 3,640	$ 4,585	$ 6,482	65.2%	$ 2,373	$ 3,046	$ 4,678
National Science Foundation							
Development in Science Education (DISE)	$ 8,105	$ 4,100	$ 0	13.6%	$ 1,102	$ 558	$ 0
Comprehensive Assistance to Undergraduate Science Education (CAUSE)	13,291	7,904	0	16.1	2,140	1,273	0
Instructional Scientific Equipment Program (ISEP)	2,771	3,200	0	19.6	543	627	0

Local Course Improvement (LOCI)	2,908	2,800	0	18.9	550	529	0
Graduate Fellowship Program e/	10,905	11,400	8,800	14.3	1,559	1,630	1,258
Science Faculty Program	3,212	3,000	0	6.7	215	201	0
Undergraduate Research Participation	2,832	3,000	0	9.5	269	285	0
Total (NSF)	$ 44,024	$ 35,404	$ 8,800	14.5%	$ 6,378	$ 5,103	$ 1,258
Cross-Agency Activities							
All Agencies							
R&D Grant Funding f/	$3,733,000	$3,906,000	$4,067,000	n.d.	n.d.	n.d.	n.d.
All Except NSF and ED							
Federal Cooperative Education Employment Program (coordinated by OPM) g/	n.d.	n.d.	n.d.	20.8%	n.d.	n.d.	n.d.
GSA, NSF, DOE							
Used Federal Property Disposal h/							
Surplus Federal Property Donation (GSA) i/	$ 118,707	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Transfer of Excess Scientific Equipment (NSF) j/	$ 24,317	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
Used Energy-related Laboratory Equipment Grants Program (DOE) j/	$ 370	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.

e/1982 funding is sufficient only for continuation of previously participating fellows, with no new starts.

f/Figures indicate R&D grant funding to colleges and universities.

g/Salaries are paid by each participating agency; cumulative totals are not available. Percent figure is portion of total program participants who are engineering students.

h/Figures for used property indicate original acquisition value of distributed items.

i/Figure indicates portion of property distributed for educational purposes.

j/Equipment distributed through these programs is intended for research purposes. An unknown portion is used for instruction.

Table 18

Funding from Programs with Education Objectives
(Budget Authority in Thousands)

Program by Category	1980 Total Funding	1980 Percent for Engineering	1980 Engineering Portion	1982 Total Request	1982 Engineering Portion
Science and Engineering Education Programs (NSF)					
Development in Science Education	$ 8,105	13.6%	$1,102	$ 0	$ 0
Comprehensive Assistance to Undergraduate Science Education	13,291	16.1	2,140	0	0
Instructional Scientific Equipment Program	2,771	19.6	543	0	0
Local Course Improvement	2,908	18.9	550	0	0
Graduate Fellowship Program a/	10,905	14.3	1,559	8,800	1,258
Science Faculty Programs	3,212	6.7	215	0	0
Undergraduate Research Participation	2,832	9.5	269	0	0
Total (NSF)	$ 44,024	14.5%	$6,378	$ 8,800	$ 1,258

Aid to Instruction at Land-Grant Colleges					
Aid to Land-Grant Colleges (Bankhead-Jones) (USDA)	$ 11,500	20.0%	$ 2,300	$ 0	$ 0
Aid to Land-Grant Colleges (Morrill-Nelson) (ED) b/	2,700	22.0	594	0	0
Total	$ 14,200	20.4%	$ 2,894	$ 0	$ 0
Cooperative Education Program (ED)	$ 15,000	11.5%	$ 1,725	$ 20,000	$ 2,300
Student Financial Assistance (ED)	$5,238,094	3.6%	$188,571	$6,421,750	$231,183
Federal Cooperative Education Employment Program (coordinated by OPM) c/	n.d.	20.8%	n.d.	n.d.	n.d.
Used Federal Property Disposal					
Surplus Federal Property Donation (GSA) d/	$ 118,707	n.d.	n.d.	n.d.	n.d.

a/1982 funding is sufficient only for continuation of previously participating fellows, with no new starts.

b/This percentage is based on 1979 data.

c/Salaries are paid by each participating agency; cumulative totals are not available. Percent figure is portion of total program participants who are engineeering students.

d/Figures for used property indicate original acquisition value of distributed items. This figure indicates portion of property distributed for educational purposes.

Table 19

Funding from Programs with Scientific and Technical Mission-Related Objectives (Budget Authority in Thousands)

Program by Mission Area	1980 Total Funding	1980 Percent for Engineering	1980 Engineering Portion	1982 Total Request	1982 Engineering Portion
Aeronautics/Space (NASA)					
Computational Fluid Dynamics Training Program	$ 375	72.0%	$ 270	$ 700	$ 504
Graduate Research Program in Aeronautics	800	100.0	800	1,100	1,100
Post-Baccalaureate Program in Aeronautics	500	100.0	500	1,982	1,982
Graduate Student Researchers Program	385	39.5	152	1,200	474
Summer Faculty Fellowship Program	1,580	41.2	651	1,500	618
Total	$ 3,640	65.2%	$ 2,373	$ 6,482	$ 4,678
Biomedical and Behavioral Science					
National Research Service Awards (Predoctoral Institutional Training Grants) (HHS) a/	$ 53,737	2.5%	$ 1,343	$ 43,284	$ 1,082
Rehabilitation Engineering Traineeship Program (ED)	104	100.0	104	n.d.	n.d.
Total	$ 53,841	2.7%	$ 1,447	$ 43,284	$ 1,082

Energy (DOE)					
University/Laboratory Cooperative Program	$ 3,200	20.0%	$ 640	$ 3,600	$ 720
University Reactor Fuel Assistance Program	1,700	50.0	850	1,600	800
Magnetic Fusion Energy Technology Fellowship Program b/	20	100.0	20	420	420
Solar Energy Meteorological Research and Training Site Program	1,000	20.0	200	1,120	224
DOE-ASEE Summer Faculty Program in Solar Thermal Research and Development	168	52.2	88	200	104
Total	$ 6,088	29.5%	$ 1,798	$ 6,940	$ 2,268
Environmental Protection (EPA)					
Air Pollution Traineeships Program	$ 380	50.0%	$ 190	$ 0	$ 0
Academic Grants in Solid Waste Technology	120	50.0	60	0	0
Academic Training Program in Water Pollution Control	438	75.0	329	0	0
Total	$ 938	61.7%	$ 579	$ 0	$ 0

a/This percentage is based on 1979 data.
b/Budget figure represents start-up costs only in 1980.

Table 19 (Cont'd)

Program by Mission Area	1980 Total Funding	1980 Percent for Engineering	1980 Engineering Portion	1982 Total Request	1982 Engineering Portion
Highway Technology and Safety (DOT)					
FHWA Fellowship and Scholarship Program	$ 459	52.6%	$ 241	$ 326	$ 171
University-FHWA College Curriculum Program	29	70.0	20	n.d.	n.d.
Center of Excellence in Motor Vehicle Safety Research	312	95.0	296	n.d.	n.d.
Total	$ 800	69.6%	$ 557	$ 326	$ 171
Maritime Transportation and Safety (DOT)					
U.S. Coast Guard Academy	$ 28,600	30.6%	$ 8,752	$ 33,500	$10,251
Aid to State Maritime Academies	11,459	50.0	5,730	10,180	5,090
U.S. Merchant Marine Academy	17,431	50.0	8,716	19,205	9,603
Total	$ 57,490	40.4%	$23,198	$ 62,885	$24,944

Mining and Minerals					
Domestic Mining and Mineral and Mineral Fuel Conservation Fellowships Program (ED)	$ 4,500	66.1%	$ 2,975	0	0
State Mining and Mineral Resources and Research Institutes Program (DOI)	10,000	72.0	7,200	0	0
Total	$ 14,500	70.2%	$10,175	$ 0	$ 0
Marine Resources (DOC)					
Sea Grant Marine Education c/	$ 1,563	n.d.	n.d.	n.d.	n.d.
Research and Development Grant Funding (all agencies) d/	$3,733,000	n.d.	n.d.	$4,067,000	n.d.
Used Federal Property Disposal e/					
Transfer of Excess Scientific Equipment (NSF) f/	$ 24,317	n.d.	n.d.	n.d.	n.d.
Used Energy Related Laboratory Equipment Grants Program (DOE) f/	378	n.d.	n.d.	n.d.	n.d.
Total	$ 24,695	n.d.	n.d.	n.d.	n.d.

c/Total includes only the portions of Marine Education that are devoted to course development, research assistantships, internships, and Sea Grant Fellowships.

d/Figures indicate R&D grant funding to colleges and universities.

e/Figures for used property indicate original acquisition value of distributed items.

f/Equipment distributed through these programs is intended for research purposes. An unknown portion is used for instruction.

Table 20

Funding for Engineering Education: Student Support
(Budget Authority in Thousands)

	1980		1982	
Program by Category	Total Program Funding	Student Support Portion	Total Budget Request	Student Support Portion
Student Financial Assistance (ED)	$5,238,094	$188,571	$6,421,750	$231,183
R&D Grant Funding (all agencies) a/	3,733,000	n.d.	4,067,000	n.d.
Training in Agency Scientific and Technical Mission-Related Areas				
Aeronautics/Space (NASA)				
Computational Fluid Dynamics Training Program	375	270	700	504
Graduate Research Program in Aeronautics	800	800	1,100	1,100
Post-Baccalaureate Program in Aeronautics	500	500	1,982	1,982
Graduate Student Researchers Program	385	152	1,200	474
Biomedical and Behavioral Science				
National Research Service Awards (Pre-doctoral Institutional Training Grants) (HHS) b/	53,737	1,343	43,284	1,082
Rehabilitation Engineering Traineeship Program (ED)	104	56	n.d.	n.d.
Energy (DOE)				
University Laboratory Cooperative Program	3,200	364	3,600	410
Magnetic Fusion Energy Technology Fellowship Program c/	20	20	420	420
Solar Energy Meteorological Research and Training Site Program	1,000	32	1,120	36
Environmental Protection (EPA)				
Air Pollution Traineeship Program	380	190	0	0

Academic Training Program in Water Pollution Control	438	197	0	0
Highway Technology and Safety (DOT)				
FHWA Fellowship and Scholarship Program	459	241	326	171
Center of Excellence in Motor Vehicle Safety Research	312	148	n.d.	n.d.
Maritime Transportation and Safety (DOT)				
United States Coast Guard Academy	28,600	1,451	33,500	1,700
Aid to State Maritime Academies	11,459	1,300	10,180	1,300
United States Merchant Marine Academy	17,431	1,393	19,205	1,880
Mining and Minerals				
Domestic Mining and Mineral and Mineral Fuel Conservation Fellowships (ED)	4,500	2,975	0	0
State Mining and Mineral Resources and Research Institutes (DOI)	10,000	1,179	0	0
Marine Resources (DOC)				
Sea Grant Marine Education d/	1,563	n.d.	n.d.	n.d.
Total	$ 135,263	$ 12,611	$ 116,617	$ 11,059
Federal Cooperative Education Employment Program (coordinated by OPM) e/	$ n.d.	$ n.d.	$ n.d.	$ n.d.
Science and Engineering Education Programs (NSF)				
Graduate Fellowship Program f/	10,905	1,559	8,800	1,258
Undergraduate Research Participation	2,832	269	0	0
Total	$ 13,737	$ 1,828	$ 8,800	$ 1,258

a/Figures indicate R&D grant funding to colleges and universities.
b/Engineering student support portion based on 1979 percentage.
c/Budget figure represents start-up costs only in 1980.
d/Total includes only the portions of Marine Education that are devoted to course development, research assistantships, internships, and Sea Grant Fellowships.
e/Salaries are paid by each participating agency; cumulative totals are not available.
f/1982 funding is sufficient only for continuation of previously participating fellows, with no new starts.

Table 21

Funding for Engineering Education: Instructional Equipment (Budget Authority in Thousands)

Program by Category	1980 Total Program Funding	1980 Equipment Portion	1982 Total Program Funding	1982 Equipment Portion
R&D Grant Funding (all agencies) a/	$3,733,000	n.d.	$4,067,000	n.d.
Used Federal Property Disposal b/				
Surplus Federal Property Donation (GSA) c/	118,707	n.d.	n.d.	n.d.
Transfer of Excess Scientific Equipment (NSF) d/	24,317	n.d.	n.d.	n.d.
Used Energy-related Laboratory Equipment Grants Program (DOE) d/	378	n.d.	n.d.	n.d.
Federally Subsidized Academies (DOT)				
U.S. Coast Guard Academy	28,600	n.d.	33,500	n.d.
Aid to State Maritime Academies	11,459	3,912	10,180	3,490
United States Merchant Marine Academy	17,431	115	19,205	127
Total	$ 57,490	$4,027	$ 62,885	$3,617
Science and Engineering Education Programs (NSF)				
Comprehensive Assistance to Undergraduate Science Education	$ 13,291	$ 589	$ 0	$ 0
Instructional Scientific Equipment Program	2,771	543	0	0
Local Course Improvement	2,908	61	0	0
Total	$ 18,970	$1,193	$ 0	$ 0

Scientific and Technical Mission-Related Programs				
Energy (DOE)				
University Reactor Fuel Assistance Program	$ 1,700	$ 850	$ 1,600	$ 800
Solar Energy Meteorological Research and Training Site Program	1,000	10	1,120	11
Mining and Minerals (DOI)				
State Mining and Mineral Resources and Research Institutes Program	10,000	781	0	0
Total	$ 12,700	$1,641	$ 2,720	$ 811
Aid to Instruction at Land-Grant Colleges				
Aid to Land-Grant Colleges (Bankhead-Jones) (USDA)	$ 11,500	$ n.d.	$ 0	$ 0
Aid to Land-Grant Colleges (Morrill-Nelson) (ED)	2,700	n.d.	0	0
Total	$ 14,200	n.d.	$ 0	$ 0

a/Figures indicate R&D grant funding to colleges and universities.
b/Figures for used property indicate original acquisition value of distributed items.
c/Figure indicates portion of property distributed for educational purposes.
d/Equipment distributed through these programs is intended for research purposes. An unknown portion is used for instruction.

Table 22

Funding for Engineering Education: Institutional Support (Budget Authority in Thousands)

Program by Category	1980 Total Program Funding	1980 Institutional Support Portion	1982 Total Program Funding	1982 Institutional Support Portion
Federally Subsidized Academies				
United States Coast Guard Academy	$28,600	$ 8,752	$33,500	$10,251
Aid to State Maritime Academies	11,459	5,730	10,180	5,090
U.S. Merchant Marine Academy	17,431	8,716	19,205	9,603
Total	$57,490	$23,198	$62,885	$24,944
Aid to Instruction at Land-Grant Colleges				
Aid to Land-Grant Colleges (Bankhead-Jones) (USDA)	$11,500	$2,300	$ 0	$ 0
Aid to Land-Grant Colleges (Morrill-Nelson) (ED) a/	2,700	594	0	0
Total	$14,200	$ 2,894	$ 0	$ 0
Scientific and Technical Mission-Related Programs				
Mining and Minerals				
State Mining and Mineral Resources and Research Institutes Program (DOI)	$10,000	$ 2,059	$ 0	$ 0
Highway Technology and Safety				
Center of Excellence in Motor Vehicle Safety Research (DOT)	312	30	n.d.	n.d.
Total	$10,312	$ 2,089	$ 0	$ 0

a/Portion for engineering support based on 1979 percentage.

Table 23

Funding for Engineering Education: Institutional Development (Budget Authority in Thousands)

Program by Catgetory	1980		1982	
	Total Program Funding	Institutional Development Portion	Total Program Funding	Institutional Development Portion
Science and Engineering Education Programs (NSF)				
Comprehensive Assistance to Undergraduate Science Education	$13,291	$2,140	$ 0	$ 0
Cooperative Education Program (ED)	15,000	1,725	20,000	2,300
Total	$28,291	$3,865	$20,000	$2,300

Table 24

Funding for Engineering Education: Curriculum Development and Dissemination (Budget Authority in Thousands)

	1980		1982	
Programs by Category	Total Program Funding	Engineering Curriculum Portion	Total Program Funding	Engineering Curriculum Portion
Science and Engineering Education Programs (NSF)				
Development in Science Education	$ 8,105	$1,102	$ 0	$ 0
Comprehensive Assistance to Undergraduate Science Education	13,291	856	0	0
Local Course Improvement	2,908	550	0	0
Total	$24,304	$2,508	$ 0	$ 0
Scientific and Technical Mission-Related Programs				
Energy (DOE)				
Solar Energy Meteorological Research and Training Site Program	$ 1,000	$ 58	$1,120	$65
Environmental Protection (EPA)				
Academic Grants in Solid Waste Technology	120	60	0	0
Academic Training Program in Water Pollution Control	438	131	0	0
Highway Technology and Safety (DOT)				
University-FHWA College Curriculum Program	29	20	n.d.	n.d.
Marine Resources				
Sea Grant Marine Education a/	1,563	n.d.	n.d.	n.d.
Total	$ 3,150	$ 269	$1,120	$65

a/Total includes only the portions of Marine Education that are devoted to course development, research assistantships, internships, and Sea Grant Fellowships.

Table 25

Funding for Engineering Education: Faculty Development (Budget Authority in Thousands)

Program by Category	1980 Total Program Funding	1980 Engineering Faculty Portion	1982 Total Program Funding	1982 Engineering Faculty Portion
Scientific and Technical Mission-Related Programs				
Aeronautics/Space (NASA)				
Summer Faculty Fellowship Program	$ 1,580	$651	$1,500	$618
Energy (DOE)				
University/Laboratory Cooperative Program	3,200	202	3,600	227
DOE/ASEE Summer Faculty Program in Solar Thermal R&D	168	88	200	104
Total	$ 4,948	$941	$5,300	$949
Science and Engineering Education Programs (NSF)				
Science Faculty Programs	$ 3,212	$215	$ 0	$ 0
Comprehensive Assistance to Undergraduate Science Education	13,291	107	0	0
Total	$16,503	$322	$ 0	$ 0

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April 1, 1981

Milton J. Socolar, Acting
  Comptroller General
General Accounting Office
Washington, D. C.

Dear Mr. Socolar:

For some time, the Committee on Science and Technology has been concerned about the health of American science and engineering education. We have recently been assisted in our review in this area by a GAO briefing document that outlined programs in engineering education in eight Federal agencies. This document, prepared by the Science and Technology group in the Program Analysis Division, has been very helpful in analyzing funding of science and engineering education within the National Science Foundation.

The Committee is very interested in GAO's ongoing work in engineering education particularly, and in science education more generally. We understand that GAO's work in progress will provide further information about current Federal activities in engineering education, as well as an analysis of the nature and extent of such activities in relation to current issues and concerns in engineering education. By this letter, we are requesting to receive the report of the project at the earliest possible date and to be kept informed of the progress of the project.

The Committee is also very interested in pre-college science education. We currently expect that the pre-college science education program of the National Science Foundation will be reorganized and refocussed for the coming year. We would like to request that, subsequent to your work on engineering education, GAO conduct a study of pre-college science education. The same approach now being pursued in engineering education -- an analysis of activities across Federal agencies in relation to current issues and concerns -- would be very useful to us. This information is not current available from any other source. We look forward to your response and thank you for your continued assistance.

Sincerely,

Doug Walgren

DOUG WALGREN
Chairman
Science, Research and
  Technology Subcommittee

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MINORITY STAFF DIRECTOR

September 3, 1981

Honorable Milton J. Socolar
Acting Comptroller General of
the United States
U. S. General Accounting Office
Washington, D. C. 20548

Dear Mr. Socolar:

Congress has become increasingly concerned about the health of American engineering education and associated problems with engineering and technical manpower. The Committee on Science and Technology has had particular interest in this issue, though it is of utmost concern to the rest of Congress given the implications in providing for a strong defense and the economic recovery of the nation.

It is my understanding that your agency, through the Program Analysis Division, is near completion of a study of engineering education programs within the Federal government. It is also my understanding that a substantial amount of information concerning those programs has been accumulated. Such a study would appear to be an important contribution to what I anticipate will be a major focus of policy debate during this Congress. In the past, reports from your organization have provided important baselines and analysis for Members of Congress to use in their deliberations of critical policy issues. I expect the same would be the case for this report.

Because of the importance of this issue and because of the widespread interest, I would like to urge that this study be as comprehensive as possible, with the fullest feasible analysis of the data you have obtained. It would be particularly important to include data and discussion of the proposed spending levels for FY 1982 contrasted with the FY 1980 levels in these Federal programs. Agency comments on this and other information contained in the report would be important in establishing its full credibility. Finally, I would hope that the report be directed as broadly as possible to the entire Congress.